THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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BRITISH ELECTRICAL AND ALLIED INDUSTRIES.

WE had the privilege on Thursday last week of attending a pleasant and charmingly informal gathering arranged by the British Electrical and Allied Manufacturers' Association, and presided over by Mr. F. R. DAVENPORT, the chairman. Between forty and fifty gentlemen, members, officials and staff of the Association, together with representatives of the electrical Press and a few other guests, were present at the Connaught Rooms, and after dinner there was a quite informal discussion on some matters in which the whole electrical industry is very much interested. Quite irresistibly our memory carried us back to those little meetings held at the Hotel Cecil about ten years ago, when, under another name, with another secretary, with another Davenport in the chair, and with—in war-time we may say it—quite another set of faces on both sides of the table, the Association struggled in its birth-throes, by dint of courage and persistence survived, soon got into useful ways—for an infant—and while doing good work according to its light and age, managed incidentally to accumulate a credit balance of £34, with a reserve of £100 invested in Consols! But we must not indulge in reminiscences—the days are too full of work for that just now—except to say that then, as now, the organisation of British electrical industry was one of the more pressing problems. That much good work has been done in that direction since then goes without saying, and much criticism has been offered, here legitimately, there illegitimately, from which it has been hoped the electrical industry would derive benefit. Last week's informal function, however, was not designed to give the Press an opportunity to review the working of the Association, or to discuss its organisation, its internal difficulties, or its external effects. It was arranged in order that, in conjunction with the Press, there might be a little informal talk on matters of general interest to the electrical and allied industries, more particularly the after-the-war position of those industries.

The subject was opened with a paper contributed by Mr. Wile, of the *Daily Mail*, who dealt with the methods of German business men as studied by himself during some years spent in their Fatherland in the capacity of an American journalist. Those who knew the author missed his personality and accent to some extent, but in his absence there was certainly no one present more capable of giving an appropriate reading of Mr. Wile's notes than Mr. D. N. Dunlop, the Association Secretary. As the discussion was to be on matters of general interest, a newspaper man who did not possess a specialised knowledge of our industries was chosen to give his experiences. He certainly succeeded in interesting those

present, and we therefore give a full abstract of the address in our pages. Possibly those who know as much of the internal doings of electrical organisations in Germany as Mr. Wile knows of the German character would not desire to be prominently before the footlights in London. The electrical man does not generally look to the daily newspaper journalist for guidance in regard to his industrial operations, yet it is as well that we should be reminded, even by such, of the devices of the German trader; of the royal patronage of science and engineering industry—as evidenced by the presence of the august Kaiser at a two hours' discourse on a new turbine; of the ability of the German industrial leader to recognise the value of the services of a good Englishman—as evidenced by the engagement of a young man of 31 years of age to develop the A.E.G. export department; and some other things which, though they may not be quite applicable to electrical industry, all go to form the complete picture of a trader of true Prussian character. In whatever respects we might have to differ from some of the conclusions of Mr. Wile, we find ourselves in complete agreement with him in his urgent advice to British traders to be prepared for what is coming after the war. The author, as an American, described himself as a "neutral," but only a neutral in so far as he did not mind by whom or how soon Prussian militarism was effectually crushed. That is just our own neutrality also, and we hope our neutral cousins will hurry forward with those munitions with "some" speed and hasten the defeat of the common enemy of civilisation.

From the conversation that followed we gathered that there was still an inclination on the part of some manufacturing interests to belittle the advice which has been given so frequently for making a closer study of the requirements of particular markets, and a more energetic effort to meet their needs and so forth, but we respectfully suggest that this kind of advice, though it may often be penned by the "daily" newspaper writer, has not its origin in the fertile brain of the imaginative journalist. It is too long a story to tell here (and it is not necessary, for it is already known to readers of the Electrical Review), but though we are not ourselves enamoured of the writings of the lay journalist on electrical matters, we positively assert that many of these things are true; they have been for years, and still are, the subject of very grievous complaints told to us in these offices by British and Colonial electrical engineers who have been long stationed in, or have visited professionally, the colonial and foreign markets. To hide one's head in the sand does not remove the danger—it merely endangers the exposed portions of the anatomy. Of course, such advice is not necessary in all cases—the firms who are not remiss know that they are not. We fear that we shall approach the new foreign and colonial trade position with too restricted an enterprise if we allow ourselves to believe that, because we have only 45 millions of people in the British Isles, and because we have only a certain estimated productive capacity, there is little chance of our succeeding in our efforts to fight German competition, and, to use the much-abused and therefore discredited phrase, to "capture the German trade." We may trust our manufacturers to know what margin of productive capacity they possessed in pre-war times, and from what some of them have told their shareholders, we gather that if they secure a fair share of German electrical trade after the war in addition to holding their normal connections, they will be able to handle it. Whether they do it by extending factories, by altered working hours, by increased efficiency of methods, means and processes, by a larger employment of woman labour, or by utilising premises built for war munitions purposes, is their own internal concern. Perhaps there may be good done by forming a new Association to study means of increasing productivity. Possibly the lessons learned in war-time respecting that curse, the limitation of output, may have a healthy effect in the years that follow. Every industrial student has watched with interest and with much anxiety the attitude of organised labour and its detrimental effects upon industry. How serious these matters are we fully recognise, but we cannot wait for such things to be remedied before we proceed with our trade efforts. We believe that there is an ample productive margin to justify whatever movements may be contemplated by members of the Association or by those who, for various reasons, see fit to stand outside its ranks.

The need for specialised skilled labour for particular departments of industry, the promotion of conditions calculated to more efficiently train and retain men of the right class or type, the adoption of co-operative principles in order to give workmen and employers a common interest—all these are matters of extreme importance, and they were very fittingly raised by speakers in the course of the discussion. They are really matters for national as well as sectional study, for they undoubtedly fill a large place in our comparative investigations of the methods employed by us and by our enemies. But we do not believe that those who raised them would favour a policy of long waiting and seeing before we elaborated measures by means of which our industries could be more equal to the inevitable accentuated onslaught of German traders, concerning whose plans we have been permitted to know something.

On Thursday last week there were those who ventured to suggest that there was need for immediate action, and it was gratifying to learn, as we subsequently did from the remarks of the Secretary, that the Association is engaged in an exhaustive investigation which will form the basis of a large and elaborate plan which, when known and developed in full detail, will be found to be equal to the new situation. We hope that such will be the case, but here we really shall have to "wait and see." The Association is in touch with Government departments at Home, and has appointed committees overseas; it is employing an increased staff upon these and other matters; and though the Secretary sounded a warning note against expecting immediate results in the form of increased dividends, he foretold a state of things which should give little ground for pessimism. If only by co-operative effort members can find a way for unity of action in markets where they have in the past acted individually in competition with each other, each in turn competing single-handed against strong, consolidated Teutonic forces, there will be better times for the industry. It may be true that the fall of Germany will be complete, and that she may be weakened in all parts of the globe, but is it not at least fairly probable that the completeness of the defeat will enhance the danger of ruinous competition? We shall impose conditions, and no doubt build fences, but many millions of Germans will still engage in industry in order to earn their daily bread. The policy of the B.E.A.M.A. does not suggest that that organisation is afraid that we shall be handicapped by any shortage of productivity. We recall the joint effort of the German Trade Committee of the Institution of Electrical Engineers and the B.E.A.M.A., the result of which was the conclusion that the continuance and expansion of British trade after the war would mainly depend (1) on economic principles, and (2) on the commercial industry and initiative of British manufacturers. Now (1) is perfectly obvious, and (2) is emphatically true. With the first we cannot seriously interfere, but initiative and enterprise we can and should

employ to the utmost of our power. The larger efforts of the B.E.A.M.A. and the smaller doings of individual private concerns to that end have our heartiest good wishes for success. If it had fears of a shortage of productivity the Association would not be proceeding with any scheme—even at this late date, as we regard it. It probably has greater cause for anxiety when it wonders how it is going to protect British electrical industry against the resumption of importing by British electrical firms.

In contributing a brief and graceful wind up to the conversation, Mr. Davenport, the chairman, showed that it was fully recognised that German after-the-war competition would be a force to be reckoned with, and that gatherings of this character were greatly to be desired.

Rubber.

There is a very strong tone in the market for crude rubber, and prices have had a considerable advance, the upward tendency being influenced to some extent, of course, by the intricacies of the shipping position, which have resulted in gradual advances in freights, to say nothing of delayed arrivals and the difficulty in discharging vessels when they do reach port. The demand certainly has been on a broader scale both for the home trade and the United States, and it is noteworthy that a number of forward contracts have been made by producing companies at prices showing a considerable advance upon recent rates. The tone is certainly one of growing confidence, which is evidenced by the fact that the demand for next year's deliveries continues to run upon broad lines, while sentiment has not been at all impaired by the less favourable statistics issued for the past month. There is a growing feeling of restlessness regarding the submarine activity in the Mediterranean, and this has impelled a certain amount of buying which would otherwise have been withheld for a time. Arrivals have been falling below the requirements for delivery, and producers seem to have had less material free for disposal than of late, while at the same time they have had to face a good demand for early stuff. The chaotic conditions of the railways is another point which has led to more active buying, for consumers have been fearful of being caught short of supplies, and have been buying well ahead, therefore, of the dates for which they require the material. As long as abnormal conditions of this kind continue to prevail, the market is bound to remain in a somewhat fidgety mood. Official returns received from the Near East give the exports from the Federated Malay States during October as 4,120 tons, compared with 3,334 tons in September, and 2,987 tons in the corresponding month of last year. The following shows the monthly totals of the export movement during the last three years.

	1913.	1914.	1915.
January	2,131	2,542	3,473 tons.
February	1,757	2,364	3,411 ,,
March	1,737	2,418	3,418 ,,
April	1,626	2,151	2,777 ,,
May	1,225	2,069	2,708 ,,
June	2,005	2,306	3,403 ,,
July	1,781	2,971	3,687 ,,
August...	2,363	1,850	3,796 ,,
September	2 000	2,879	3,334 ,,
October	2,160	2,897	4,120 ,,
Total	18,785	24,447	34,127 ,,

The Decimal System.

We are pleased to note that we do not stand alone in regarding the reform of our weights and measures as one of the most important steps to be taken in preparation for the impending trade war with Germany. It is reported that the Council of the London Chamber of Commerce is holding a special meeting this week to consider the whole question of trade relations after the war between Great Britain and her Dominions and Allies on the one side, and our enemies on the other, and considers the adoption throughout the Empire of the metric system one of the most pressing questions; every member of the London Chamber has been urged to introduce the system into his own business at once, as it is felt that Germany has an unquestionable advantage over Great Britain in all neutral markets owing to our retention of an archaic and time-wasting method of weighing and counting.

In its October issue the *Mining Magazine* discussed the question of weights and measures, pointing out that the application of the decimal system to amounts less than unity, as it is applied to amounts greater than unity, was not only logical but highly convenient, and advising engineers to use the metric system wherever possible, and always to champion it.

The *Contract Journal* also, in its issue of October 27th, treated of the metric system and foreign trade, and advocated the use in price lists of weights and measures familiar to the customer, as well as quotations in the local coinage. Our contemporary proceeded to quote from our circular, and to indicate the trend of the answers received, offering a welcome to the metric system where its adoption arises naturally out of the needs of trade and commerce.

We are somewhat at a loss to understand why the *Journal* dismisses the question of the general adoption of the metric system and decimal coinage in this country as having "small relevance to foreign trade"; a study of the history of the subject shows that manufacturers, merchants, engineers, scientists, trading associations and other important bodies have consistently held the view that the reform would have a profound influence in facilitating and promoting our foreign trade, as well as our domestic convenience.

An article published by the Chamber of Commerce of the United States exactly a year ago vehemently urged the universal use of the metric system as necessary to the development of foreign trade, and maintained that all commerce and industry would benefit by its adoption.

In the serial article which has been running through our pages during the past few weeks, we have endeavoured to demonstrate the advantages of the decimal system, and to show that the difficulty of substituting it for our existing methods will be far less than its opponents would have us believe.

Copper.

Our thanks and congratulations are due to Mr. Welbourn, chairman of the Manchester Section of the I.E.E., for his welcome departure from the stereotyped form of inaugural address. The author is an authority on copper and its applications to the purposes of the electrical industry, and having discovered that no paper on copper—the staple raw material of the industry—had ever been read before the Institution, he decided to make good that remarkable omission. For the adoption of this course admirable precedents could be cited if it were necessary; but in these days precedents have lost their weight, and the stern trials to which the nation is being subjected are sweeping aside our tendency to cling to form and ceremony, and are bringing us face to face with the things that really matter.

As the author points out, our copper standards are at present somewhat out of date, and call for the attention of the Engineering Standards Committee; no satisfactory definition of "hard-drawn copper" exists. There is also ample scope for further research in connection with the properties of copper wire, and the author suggests that this might very well be undertaken by the Research Committee of the I.E.E.

An interesting point is a reference to the behaviour of copper wire when first erected, the process of pulling out the kinks giving the wire a fictitious modulus of elasticity; Mr. Welbourn considers it preferable to strain the conductors to a tension higher than that at which they will be permanently sagged, to get rid of the kinks, after which the normal modulus can be safely employed. Some new information is given on the effect of temperature on the strength of copper, a subject about which little is known. The address forms a valuable supplement to the excellent paper on overhead line construction which the author read last year.

DECIMAL COINAGE AND THE METRIC SYSTEM.

(*Continued from page* 637.)

Now, in modern workshops, in which work of high accuracy is turned out and close limits are prescribed, where a fit is necessary, it is not customary to figure the dimensions in vulgar fractions of an inch, because we should have to deal with such fractions as 1/1,024 in order to attain the desired degree of precision; even the most ardent advocate of inches never goes beyond the 1/64th in figuring a drawing, nor have we heard of a micrometer divided in 1/1,024ths of an inch. The practical man would say such procedure was absurd, and so it would be; unfortunately he does not pursue the matter to the logical conclusion. He adopts decimal fractions, even to the third and fourth places of decimals (as we shall show), but sticks to his halves and eighths and thirty-seconds, even on the same drawings! We give an example (fig. 2) culled from a recent issue of the *American Machinist*.

Be it noted that this is not a case where limit gauges are in question; it is simply due to the impracticability of stating the dimensions in vulgar fractions. Fig. 3, from the same source, representing a tool used in manufacturing British shells, illustrates the same point; but figs. 4 and 5 show the necessity of using decimals in defining limits for gauges. These fine dimensions are only worked to in the tool-room, where there is a staff of highly skilled and well trained workmen; in the shops, the

of "standard tolerances and allowances" for first quality work, given in Report No. 27 on limit gauges for running fits:—

Nominal diameter.	Shaft. Minimum diameter.	Shaft. Tolerance (difference).	Shaft. Maximum diameter.	Allowance.	Hole. Minimum diameter.	Hole. Tolerance (difference).	Hole. Maximum diameter.
¼	·2495	·0005	·25	·0005	·2505	·0003	·2508
½	·4993	·0007	·50	·0007	·5007	·0007	·5014
¾	·7491	·0009	·75	·0008	·7508	·0009	·7517
1	·9990	·0010	1·00	·0010	1·0010	0010	1·0020
1½	1·4988	·0012	1·50	·0012	1 5012	·0013	1·5025
2	1·9985	·0015	2·00	·0015	2 0015	·0015	2·0030
4	3·9980	·0020	4·00	·0020	4·0020	·0020	4·0040
8	7·9975	·0025	8·00	·0025	8·0025	·0025	8·0050

The tables for 2nd or 3rd quality work would have illustrated our point equally well; it is perfectly obvious that vulgar fractions have here no place (except in the *nominal* column!), and that four places of decimals are necessary to embody the desired facts in terms of the inch. Let us here repeat that the hundredth part of a millimetre—two decimal places—represents a greater degree of accuracy than can be attained under practical conditions in the workshop. It can, no doubt, be improved upon in the tool-room, by the exercise of the greatest care and skill; but the tool-room is the domain of specialists whose business is to make fine measurements and work to them. In the shops refined methods of measurement are uneconomical and out

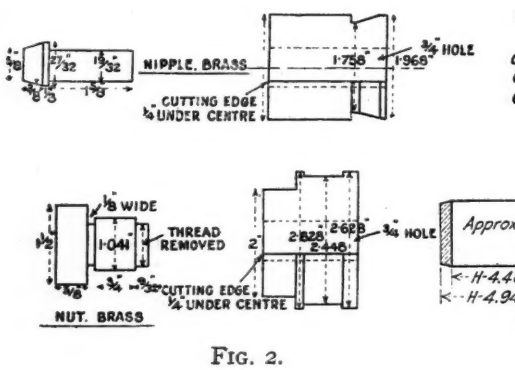
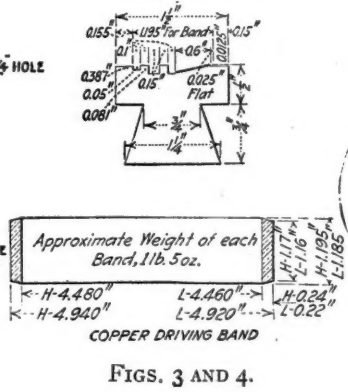


FIG. 2.



FIGS. 3 AND 4.

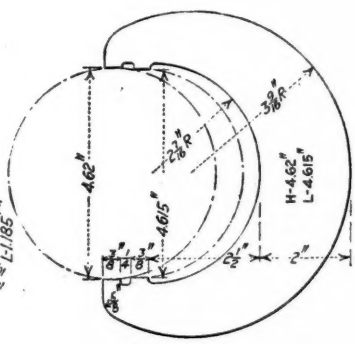


FIG. 5.

smallest dimension usually worked to is 1/32 in., unless a jig or gauge is used to relieve the workman of the necessity of possessing skill. Now, the millimetre is about 1¼ times as large as 1/32 in., and the half-millimetre, which is, as already mentioned, about the limit for apposition measurements, is approximately 1/50 in., or roughly ⅘ of 1/32 in. Hence the millimetre scale is at least as suitable for use in the shop as the inch scale, and has the enormous additional advantage of being divided decimally.

We have laboured somewhat to demonstrate that (1) inch men use decimals freely; (2) they cannot dispense with them; (3) metric men achieve greater accuracy with fewer decimal places; (4) it is easy to substitute millimetre dimensions for inches on a drawing, with an accuracy beyond practical requirements, without "strings of decimals"; (5) the manipulation of metric dimensions is easier and quicker than that of inch dimensions. Before leaving this part of the subject, let us see what is the practice of the British Engineering Standards Committee. It has been hinted that the Committee was originally constituted partly to combat the growing demand for the metric system, but this, no doubt, is a libel; not only does the Committee use the metric system upon occasion, but also its tables afford some of the most striking object lessons of the inconveniences of the inch. We reproduce below a portion of the table

of place, and are obviated by the use of accurate gauges and jigs made in the tool room. As our contention may be disputed, we cite in support of it the voluminous report, No. 25, of the Engineering Standards Committee on Errors in Workmanship—an extremely interesting document.

This report was drawn up as a preliminary step towards the standardisation of a system of limits, and was based upon an extended investigation of the errors of workmanship incurred in 13 workshops in turning shafts and boring holes—plain cylindrical work, the easiest of all shapes to machine accurately. The measurements were made by the National Physical Laboratory, which reported that "accuracy of measurement beyond 0.0005 in. was seldom attained, owing to the presence of foreign matter and the variation of temperature." Thus, an expert can only hope to measure with an accuracy of *half a mil* under workshop conditions; and half a mil is greater than a hundredth of a millimetre. Hence shop measurements never need be taken beyond .01 mm.

The measured "Error in Workmanship" is defined as the difference between the size aimed at and the actual size of the work, and for the latter the *mean* of many measurements is taken as the actual dimension. We shall return to this point later. In the case of specimens manufactured on the limit gauge system, the "size aimed at" has been taken

as the mean between the stated high and low limits. On this basis, the report shows that, in general, the error of workmanship on shafts averages 1.6 mils, varying roughly from 1 mil on a 2-in. shaft to 2 mils on an 8-in. shaft, though the error is not necessarily proportional to diameter, and in the case of holes, the results showed little relation to diameter, but averaged 1.8 mils. When the data were classified, work manufactured to limits came out best, with general averages of 0.85 and 1.2 mils for shafts and holes respectively. Ground specimens showed 1.1 mils, against 1.9 mils for shafts not ground. Work not manufactured to limits gave 2.2 and 2.3 mils for shafts and holes respectively.

Classifying in terms of purpose, we have this table:—

Class of Work.	Average error of workmanship. Shafts.	Holes.
Small tools	.0005 ...	.0010
High speed engines and dynamos	.0011 ...	.0010
Gun mountings	.0012 ...	.0014
Gas engines	.0020 ...	.0028
Locomotives	.0031 ...	.0025
Large machine tools	.0025 ...	.0033

These figures relate to the average diameters of the shafts and holes; but the specimens are generally somewhat taper and often elliptical, 30 per cent. of all the shafts and 46 per cent. of all the holes having a variation of at least .001 in. in diameter, and 13 per cent. of all shafts, 29 per cent. of all holes, being elliptical by that amount.

The committee gave the following formula for limits:—

Limit/2 in mils $= \pm(0.1D + 0.5)$ where D is the diameter in inches. This gives from a minimum of 1 mil total tolerance up to 3.4 mils at 12 in., but from 5 to 12 in. diameter the slope is reduced, to give 3 mils at 12 in. ("Tolerance" is "a difference in dimensions, prescribed in order to tolerate unavoidable imperfections of workmanship.")

It would be a mistake to infer from the statement that the "error in workmanship" is, say, 1.6 mils, that that figure represents the limit of error; on the contrary, as stated above, it is an *average* figure, and when the tabulated details of measurements are examined it is seen that the maximum errors—which are of great importance, for a shaft that would apparently fit a hole on the average basis may actually not enter it at all owing to the maximum errors being greater—are often much more significant. This fact is well illustrated by the circumstance that, although the investigators say they were seldom able to attain an accuracy within half a mil, the bulk of their data are given in tenths of a mil! A few examples, taken from one of the highest classes of workmanship—high-speed engines and dynamos—may be cited:—

Nominal diameter.	Taper mils.	Elliptical mils.	Tolerance mils.	Error mils.
1.502 (hole) ...	1.0 ...	0.3 ...	0.75 ...	0.0
2.375 (shaft) ...	0 ...	1.0 ...	1.0 ...	0.6
2.378 (hole) ...	1.5 ...	0 ...	1.0 ...	0.3
2.375 (shaft) ...	1.0 ...	0.5 ...	1.0 ...	0.2
2.378 (hole) ...	1.5 ...	0.5 ...	1.0 ...	0.3
4.0055 (hole) ...	2.5 ...	1.0 ...	2.5 ...	0.0

Here we see that a bearing is found to be 1 mil taper and 0.3 mil elliptical; yet the "error in workmanship" appears as 0.0! In another case the taper is 1.5 mils; the "error" appears as 0.3 mil; and the last example is still more striking, a taper error of 2.5 mils and an elliptical error of 1 mil being so far neutralised by other errors that the resultant error is 0.0. Even on this peculiar system of reckoning "errors," according to which a shaft journal may be made to appear absolutely correct if it is 2 mils large at one end and 2 small at the other, the average error of all the 500 specimens examined, as stated above, was over 1½ mils.

One of the most weighty objections to the metric system is the theory that jigs and gauges and patterns will have to be altered, at very great expense to engineering works. As regards patterns, a little consideration will show that there is not the slightest necessity to alter these; as we have pointed out, the accuracy with which a casting is produced is not a matter of a thousandth or even a hundredth of an inch. The many sources of error in this work—uncertain shrinkage, enlargement of the mould in withdrawing the pattern, inaccuracy of fit of the flasks, and warping of the casting, render it useless to aim at a result within half a millimetre of the desired dimension. Hence drawings of castings can safely be figured to the nearest whole millimetre without touching the patterns. Neither is there generally any occasion to alter dies for die-casting, or for forming small articles in presses, remembering that what is aimed at is the correct result, and the mere fact that the dimensions of the result are expressed in inches or millimetres has no bearing whatever upon the suitability of the article for its intended purpose, *unless it has to fit some other part.* Articles manufactured by these processes could be figured to the tenth of a millimetre, which would in general be smaller than the error of workmanship.

As for jigs and gauges, these are wholly a matter for the tool-room. There is no need to alter them at all, because, being usually figured in thousandths of an inch, they can just as easily be figured in hundredths of a millimetre—with a gain in accuracy, on paper. Another point which must not be overlooked is the fact that both these types of appliances have a comparatively short life—not that they necessarily wear out quickly, but changes in design, which are always occurring or impending, put an end to their usefulness. With few exceptions, the life of jigs can be put at not more than two or three years—a writer in the *American Machinist* recently estimated it at not over one year—and therefore, if it is judged essential to alter a jig because it is to be measured in millimetres instead of inches—surely a curious reason—it is grossly unfair to charge all the cost to the metric system.

Gauges, if of standard dimensions, might have a longer life than jigs, but it must be remembered that they are liable to wear, and must be checked and readjusted from time to time; the slight alterations that might be necessary to bring them to convenient metric dimensions could be made on these occasions, and though they would not be inexpensive, they would, at any rate, involve only the adjustment of existing gauges, and not the construction of entirely new gauges. That new micrometers and other fine measuring appliances would be needed in the tool-room must be admitted; but these would not involve a cost that could be regarded as prohibitive.

The fact that, when the need arises, work is done to metric measurements, without the least difficulty, knocks the bottom out of the allegation that the room must be admitted; but these would not involve immense cost. It is not true. Neither the workmen nor the machines offer any difficulties; there is no need whatever to alter jigs and gauges, or to change shop standards. Only the drawings require redimensioning, and anyone familiar with shop methods in a progressive works knows that to alter a drawing is an everyday proceeding. In this connection we wish especially to emphasise the following points:—where interchangeability is necessary, the measurements usually must be taken to the thousandth of an inch (which is fully covered by the hundredth of a millimetre)—and are effected by means of gauges—limit gauges or otherwise. These gauges are prepared and adjusted in the tool-room, and the workman who uses them does not need even to know the dimensions to which they are made; only the tool-room mechanics are concerned with them. The workman, in fact, does not work to inch measurements or millimetre measurements; he

works to his gauges, and nothing else, except in the case of dimensions the accuracy of which is of no importance. The latter can, therefore, be taken to the nearest millimetre or, at the very most, to the tenth of a millimetre (0.004 in.). Where standards have been prescribed by the Engineering Standards Committee, there is usually no need to alter them; they can be expressed in terms of millimetres to the necessary degree of accuracy, *with fewer decimal places* than the inch measurements. To illustrate this point we give an example based upon the table given on p. 644 in inch measurements. It will be seen that the millimetre table, although not originally drawn up in mm., presents no difficulties.

Nominal diameter.	Minimum diameter.	Tolerance (difference).	Maximum diameter.	Allowance.	Minimum diameter.	Tolerance (difference).	Maximum diameter.
inches	mm.	mm.	mm.	mm.	mm.	mm.	mm.
¼	6·337	·013	6·350	·013	6·363	·007	6·370
½	12·682	·018	12·700	·018	12·718	·018	12·736
¾	19·027	·023	19·050	·020	19·070	·023	19·093
1	25·375	·025	25·400	·025	25·425	·025	25·450
1¼	38·069	·030	38·099	·030	38·130	·033	38·163
2	50·761	·038	50·799	·038	50·837	·038	50·875
4	101·547	·051	101·598	·051	101·619	·051	101·700
8	203·133	·064	203·196	·064	203·260	·064	203·324

As regards the objection raised on the score of screws, this is a bogey which has long been laid. In the first place, it is well known that metric threads can be cut with English leading screws, and English threads with metric leading screws. We have before us an advertisement of an American lathe, in which this is referred to.

In the second place, when screws are cut on different lathes, they are never accurately interchangeable unless the leading screws were both cut with the same original leading screw. It was for this reason that the National Physical Laboratory some years ago erected a special lathe for the express purpose of cutting leading screws for British engineers. Screws and nuts are only truly interchangeable when thus produced from a common origin, either the same leading screw or the same taps and dies. Hence here again the workman is not concerned with the system of measurement in use, but only with ready-made tools.

(*To be continued.*)

OUR TRADING OPPORTUNITIES THROUGHOUT THE WORLD.

(*Continued from page 614.*)

The Trade of China.

Germans Pushing British Goods!

We have so recently reprinted the excellent address of Mr. Riddle, delivered at Birmingham, that it may seem that the British firms have enough advice and information to go on with in regard to China as a market. But we are hearing so much about the ways of the German in worming his way into that country that we must place a number of statements on record. Mr. Ainscough, our British Trade Commissioner, is addressing British business people in this country on impressions gained during his investigation of the China market. He has shown that the pushing of British manufactures there has been left largely to German merchants. To those who say, "What does it matter who sells the goods so long as they are British made?" Mr. Ainscough replies that the German will not sell British goods one moment longer when he can find ways of getting the same sort of thing made cheaply in the Fatherland. It is common knowledge that the German did a big sale of British goods in Warsaw, because the people there insisted on having them, but his sense of patriotism in trade is unquestionably strong, and he won't sell anything British if he can help it. Mr. Ainscough advises British traders to co-operate more generally with British distributing houses in China. There is, from what we have just heard, energetic work being done by some British firms operating here and in China. We have been told of a firm of merchants not unconnected with the engineering trade who, finding their occupation more or less gone at the outbreak of the war owing to the operations in Northern France, and to the stoppage of German exports by our Fleet, dispatched a small army of travellers to a certain foreign market to book "after the war" contracts. The firm is British, and its enterprise is highly commendable, but of course the business will be placed where it is most convenient to get it executed—perhaps here, perhaps in the States, perhaps with suspected neutrals, perhaps even in enemy countries. Is it not preferable that British manufacturers should themselves, through their own representatives or organisations, be securing the business for British works?

German Methods.

H.M. Consul, V. L. Savage, in his report for the year 1914 on the trade of Changsha, refers to the steady growth year by year of the recorded value of that trade, but he says that it is more an index to the extent to which such trade is steamer-borne than of the actual increase in the volume. He states that the overwhelming preponderance of British shipping is due to the energy and enterprise of British shipping firms long established in China, but the lack of enterprise on the part of British merchants in general (with two or three exceptions, and these are youthful importing firms) has left the development of the valuable trade of Hunan to be done almost entirely by their German competitors. He says that the latter have done most of the pioneering work with characteristic patience and perseverance. "They have earned the profits they have made and the advantages they have acquired." But, he adds, the methods adopted by Germany cannot be reckoned as sound in all respects, and they are demoralising to the Chinese. "These methods are based to a certain extent on economic factors and conditions which do not apply, on the whole, to British trade and manufactures, even of a parallel order." The engineering trade is quoted as affording a good instance of the differing conditions and methods. Consul Savage continues:—

Germany's Big Output.

"The enormous output of the large German engineering works demands outlets in many markets, in order to secure continuity of production. Temporary sacrifices may have to be made, in consequence, with a view to obtain and preserve a hold on those markets. These take the shape of low initial prices, long credits, and even loans to purchasers of German machinery, on the sole security of contracts under which the latter are more or less tied down to obtaining any further supplies of machinery they may require from the same source, during a term of years; or to provide a *quid pro quo* for the loan, which may not carry payment of interest, in the shape of raw or partly manufactured products, delivered at profitable rates to the German purchasers thereof. In the meantime, it may be noted, the Chinese clients have to pay heavily for accessories and fittings, which, being especially adapted to the plant sold to them, have to be obtained from the same or affiliated manufacturers, whereby the latter make excellent profits. I have good authority for saying that British manufacturers do not, as a general rule, produce on the same scale as the Germans. Their capital, their works and their output are usually smaller. While they may be able to supply articles of equal and sometimes even better quality at approximately the same price, they may not wish to cut down their profits or wait for them; or they may prefer to sell in other markets where they need not do so. These are some of the principal reasons for the predominance of the German over the British engineering trade in China. It is due as much to different economic conditions as to the lack of the necessary organisation and enterprise on the part of British engineering manufacturers."

Modernised Methods Succeed.

The success of a number of younger British firms trading in general manufactures on modern lines is quoted as proving beyond question "that an increase in expenditure on a larger European staff and more agencies is amply warranted by results." But this system is not followed by the old-established merchants, who have hitherto preferred to centralise their trade at the few large importing centres and to deal only in large quantities of goods at a time, and have been content to leave the distribution at long range, entirely in the hands of native middlemen. Consul Savage says that there is no necessity for maintaining this system, indeed, there are good reasons for discarding it. Competition among

foreign merchants themselves enables the shrewd Chinese trader to cut down their profits more and more, not infrequently to a minimum. While they are keen enough to make use of the foreigner and his money, the Chinese readily combine together against him. The effects of such a combination are easy to bring about, and extremely deadly where large interests are concentrated at one spot. "The remedy is clearly to adopt a more open formation." In the case of a highly centralised trade, the Chinese middlemen can and do combine together to control the trade, and make too many profits for its welfare and vitality. Any attempt on the part of Europeans to introduce useful innovations calculated to secure better results or an expansion of business is apt to be met by the threat, or the reality, of a boycott, if the middlemen's profits are at all jeopardised. German business houses have a number of European agents up-country for the sale or purchase of goods, most of them able to converse with the natives, study their requirements, and make bargains with them if necessary—having realised the great value of a knowledge of the Chinese language on the part of their agents and salesmen. The report later shows that it is due to the efforts of German firms that the former native prejudices and other factors which raised great difficulties in the way of the successful exploitation by Europeans of the vast mineral wealth of China have been overcome.

The Travelling Hun.

"The export of certain ores and metals is now a principal feature of the trade of Changsha. . . . British enterprise has had practically nothing to do with it." In considering the golden prospects of Changsha, Mr. Savage asks: To what extent is British trade represented at Changsha? "The answer is that, including two shipping companies, there are two British firms having European agents at Changsha; seven more, including two non-European insurances companies, are more or less inadequately served by native agents. That is all! As against that, a year ago, there were here 11 German firms represented by 14 Germans, one Briton, and two Chinese agents. Owing to trade depression and the war, four of these firms have now closed down and four Europeans only remain at present to represent the more important houses. But it must be noted, on the other hand, that the mineral trade of the province is still predominantly in German hands, as well as its produce trade, the main outlet of which is the neighbouring port of Changteh, now about to be opened to foreign trade and residence. Branches of several German exporting firms are already established there, but no British firms are represented except by native agents. Two British mining engineers who have lately been travelling in the interior of Hunan report that, at almost every place where the prospect of mineral produce shows especial promise, the Germans have already entered into relations with the mine owners and established some sort of a hold. In addition to the Germans, there are also at Changsha agencies of five important Japanese firms and about a dozen smaller ones, and the number of Japanese subjects is greater than that of any white race, excluding missionaries. From this it will be seen that our wide-awake and enterprising commercial rivals are taking advantage of good opportunities for the expansion of their trade which, while equally open to the British merchant, are not receiving from him the attention which they should command.

Plenty of Room for the British.

The real fact of the matter is, there is plenty of room for more British firms than now exist in China. New capital and new blood are wanted to rejuvenate our trade. The newcomers, if any, will no doubt have to build up their trade connections; but this is an easier task in China than in any other country. New firms will have to engage men of local experience, and train others; but they will not, like the older firms, have to break through the opposition of their old-established connections among the Chinese and institute new and unpopular methods, while they will have less, or nothing, to lose, and much to gain. As regards Changsha, a warning is needed. The place has a great future before it, but space for residential and business quarters is very limited. The value of land is already high and tends to increase rapidly. In a few years' time costs of installation will be such as to require a very considerable outlay. The first in the field will score heavily in this respect."

Lead and zinc metals are exported in the form of ore, the output of lead during 1914 being close on 4,000 tons and that of zinc 12,894 tons. The producing source is the Shui K'ou Shan lead and zinc mines, the output of which is controlled by three German firms, while the machinery used is either of German or local make. For it is the fact, however remarkable, that a foreign-trained Chinese mechanical engineer, assisted by a staff of foreign-trained Chinese fitters and mechanics, turns out on the spot, in a remote district of Central China, a number of articles of modern machinery which serve their purpose excellently.

Several years ago the output of the Shui K'ou Shan mines was pledged for six years to a German firm, in return for an advance of 1,000,000 taels (about £150,000) wtihout interest. By this arrangement the firm in question, although probably unable at present to finance this branch of its trade, has nevertheless continued to take delivery of the supplies of ore, the value of which goes to repay the loan. The ore itself is stored in the firm's warehouses at Wuchang until circumstances allow of its disposal.

The Demand has to be Cultivated.

In the present comparatively undeveloped state of the Hunan market it is not possible to gauge to what extent it might be made to absorb particular items out of the vast range of British-manufactured goods. Cheap but serviceable tool steel and tools, machinery, electrical fittings, lamps and lampware, caps and hats, enamelled ware, needles, and a number of other articles of common use and low cost, already find a considerable market. Among the restricted class composed of the Hunanese gentry there is much wealth, and certain luxuries, the nature of which would be required to be ascertained, would no doubt find an ever-increasing number of purchasers. It is rather a question of educating the market up to a higher standard of requirements. But to obtain this object personal enterprise is a *sine quâ non*. Trained travelling agents could do much useful work in this direction. But more effective, perhaps, would be some kind of an emporium, in which a large variety of goods could be exhibited and sold at reasonable rates under foreign supervision. In the case of articles not suitable for a retail trade, show-rooms are indicated.

(To be continued.)

THE PRODUCTION AND PROPERTIES OF ELECTROLYTIC COPPER.

By B. WELBOURN.

(*Abstract of Chairman's Address, delivered to the* Manchester Local Section of the Institution of Electrical Engineers, *November 16th*, 1915.)

Nearly everyone of us is a user, in some form or another, of electrolytic copper. A search of the Institution records for twenty years discloses no paper devoted to it, although it is a prime necessity of every electrical engineer.

The world's output of copper in normal times is about 1,000,000 English tons per annum, the highest production being that of approximately 1,006,000 tons for 1912. Of this, the U.S.A. alone produced 55 per cent. (against 572 tons only in 1850), the whole of North America produced 66 per cent., and North and South America together produced 73 per cent. As this huge quantity is mainly controlled from the U.S.A., it is easy to see how the copper prices of the world are regulated from there.

Japan is the next biggest producer with 65,000 tons. Spain and Portugal gave 59,000 tons, Russia 33,000 tons, Australasia 47,000 tons, while the combined production of Germany, Hungary, Turkey, and Bulgaria on a peace footing is about 35,000 tons. The British Isles produce 300 to 400 tons only now, whereas the native production was 15,968 tons in 1860.

The world's production in 1850 was 52,400 tons. It had reached 334,565 tons in 1895, and this had trebled by 1912. In the same period, the output of the British Empire was more than quadrupled from 23,495 to 99,440 tons. The increasing production and consumption correspond with the development of the applications of electricity.

The statistics for 1912 show that the principal manufacturing countries absorbed copper as follows:—

	Tons.		Tons.
North America	365,922	Austria-Hungary ...	50,590
Germany	243,173	Russia	38,818
England	147,551	Italy	34,378
France	106,753		

Copper is nearly always associated with gold and silver, which can be electrolytically separated from it, and are now recovered instead of being lost, as was usually the case until electrical methods were available. About 70 per cent. of the world's output of copper is refined electrically, and from the 461,583 tons refined in the U.S.A. in 1907, 13,995,436 oz. of silver and 272,150 oz. of gold were recovered by electrolytic separation.

Most of the ores have to be calcined before smelting, in order to get rid of part of their sulphur, and this is done in mechanical calciners. After partial calcination, the ore is smelted (usually in a cupola furnace) to extract the earthy matter and to concentrate the copper, etc., with part of the sulphur and iron into a matte. This matte will run from 45 to 50 per cent. of copper, and then it is transferred to a Bessemer converter, which blows it up to 97 per cent. to 99 per cent. with the gold and silver contents, and is the result of treating ores which have sometimes only 3 per cent. to 4 per cent. of copper originally. The copper is run from the converter into slabs about 18 in. by 28 in. by 3 in., which are then transferred to the refinery, where they are again melted for 24 hours in a reverberatory furnace with a capacity of 150-200 tons of copper for further purification. The copper from this furnace is run into moulds to form the cast anodes, which are usually 36 by 36 by 1½ in. thick, and weigh 500 lb. each.

Under good conditions, in the U.S.A. works the cost of converting a 50 per cent. matte to metallic copper is about ¼d. per lb. of refined copper.

Most works employ the multiple system, in which anodes of cast copper and cathodes of electrically deposited copper strippings 36 by 36 by 1-32 in. thick are hung in lead-lined vats. The space between the electrodes is 1½ to 2 in., and the pressure employed is about 0.3 volt for every pair of electrodes in series. The electrolyte is an acidulated solution of cupric sulphate, and contains 1½ to 2 lb. of $CuSO_4$ and from 5 to 10 oz. of H_2SO_4 per gallon of water, and is maintained at a temperature of 130 deg. F. The current density is usually 7½ to 12 amperes, and should not exceed 18 amperes per sq. ft. of anode surface, as it has been found by experience that the mechanical properties of the metal depend on the current density used. With this latter density a high temperature and rapid circulation of the electrolyte must be maintained.

In practice, 1½-in. thick anodes decrease in thickness in ten days to ½ in. thick, and pure electrolytic copper is deposited on the cathodes until they are just over ½ in. thick, while the precious metals settle as slime at the bottom of the vat. The ½-in. thickness of anode which is left is returned to the anode furnaces for re-melting and further casting.

Theoretically, with a 100 per cent. current efficiency and 0.3 volt between electrodes, 1 lb. of copper should require about 0.115 KW.-hour, but, in practice, the gross KW.-hours required for refining and for power and lighting in the largest works is 0.14 to 0.15 KW.-hour. The overall cost of the electrolytic refining of copper is not published by the refiners, but it is believed to vary from a farthing to three-eighths of a penny per lb. The finished cathodes are melted down, blown with air, poled, and then cast into wire bars, the average weight of which is 140 lb. in England, and 220 lb. in the U.S.A., but if required by the wire manufacturers, special bars up to 800 lb. in weight can be produced.

For the transmission of electricity two varieties only are required:—

1. Hard-drawn copper, which comprises all conductors in which mechanical strength is required; and
2. Soft or annealed copper, which comprises all conductors which are to be continuously insulated, and in which the highest obtainable conductivity is required.

Bus-bars for switchboard work may either be hard-drawn or annealed as required.

The actual manufacture of wire from wire-bars is a straightforward process, and wires can be successfully drawn from 1 mil. in diameter, of very considerable lengths, up to 0.2 sq. in. sectional area in lengths up to 7,000 ft. The wire-bars are heated in furnaces to a bright red heat and are then "broken down" in rolls, and afterwards rolled in the rod mill into rods which are coiled up while still hot. In this process the copper oxidises rapidly, and it is necessary to remove the scale by acid pickling and by washing. The removed scale is readily convertible back to copper by an electrolytic process. The clean coils are taken to the wire-drawing machines, in which the rod is drawn into wire by means of chilled iron and/or diamond dies according to the size. Wires of No. 17 S.W.G. and under are usually drawn through diamond dies only.

The number of dies or "holes" through which the wire is drawn down to the required diameter depends on whether the wire is to be used "hard" or "soft," and, if the former, on what tensile strength and other mechanical properties are needed. Generally speaking, the greater the number of holes or dies, the higher is the resultant tensile strength.

DRAWN SPECIMEN (Mr. T. Bolton).

Diameter in inches.	Tensile strength, tons per sq. in.	Elongation p.c. in 10 inches.
0.500	23.68	3.8
0.400	25.62	3.0
0.300	28.30	2.6

When hard-drawn wire is needed, it is now ready for use either as a single wire, *e.g.*, a trolley wire, or it can be stranded into a more flexible conductor for use on an overhead transmission line.

If soft copper is needed, the hard-drawn copper can be treated in a number of ways. The modern process most used for annealing copper and other non-ferrous metals is that known as the "Bates and Peard," or some variation of it. The system consists essentially of a cast-iron retort which is heated externally, and which is sealed by water at both ends to prevent the entry of air through the descending mouthpieces. The retort is filled with water vapour under pressure at a temperature of about 800 deg. F. for small wires, and 1,100 deg. F. for larger wires, and the copper which is to be annealed is carried slowly through the heated tube by means of an endless conveyor. When the copper comes out of the retort, it is found to be perfectly annealed and to be as bright in colour as it was before treatment, while there has been no loss of weight. The heat remaining in the coils of wire is sufficient to cause the water from the seals to evaporate and leave quite dry wire, which is then ready for stranding and insulating.

Where long lengths of wire are required, it is frequently necessary to joint wires together during manufacture. In the smaller sizes which are used in the construction of insulated cables this may be done conveniently and economically by the use of electrical butt-welders.

For trolley wires, some engineers prefer that copper wire bars of suitable weight should be used to ensure getting the lengths required without any joints. An alternative to this is to joint the rolled rods (from which the wire is to be drawn) by means of scarfed joints which are brazed together with silver as the solder, and extensive experience of this method shows that it is entirely successful. Both this and the electrically-welded joint referred to earlier will stand drawing down through the dies, and, in the finished wire, the joint cannot usually be detected by the eye, nor is its tensile strength any less than that of the rest of the wire. In fact, it is usually higher.

BRITISH STANDARD FOR COPPER CONDUCTORS.

The first attempt to standardise copper conductors was made by an I.E.E. Committee, whose report was published in January, 1900.

The standard at present in use is the one issued by the Engineering Standards Committee (No. 7, revised March, 1910), but it is understood that this is under revision, which is certainly needed, in view of the International Electro-Technical Commission's Publication No. 28, *International Standard of Resistance for Copper*, March, 1914, which has already been adopted in the new standardisation rules of the American Institute of Electrical Engineers, dated July 1st, 1915, as follows:—

1. At the temperature of 20 deg. C. the resistance of a wire of standard annealed copper 1 metre in length and of uniform section of 1 sq. millimetre is 1/58 ohm = .0172414 ohm (20 deg. C. = 68 deg. F.).
2. At a temperature of 20 deg. C. the density of standard annealed copper is 8.89 grammes per cubic centimetre (554.985 lb. per cubic foot).
3. At a temperature of 20 deg. C. the "constant mass" temperature coefficient of resistance of standard annealed copper measured between two potential points rigidly fixed to the wire is .00393 = 1/254.453 per deg. C. (.00218333 = 1/458.016 per deg. F.).
4. As a consequence, it follows from (1) and (2) that, at a temperature of 20 deg. C. the resistance of a wire of standard annealed copper of uniform section, 1 metre in length and weighing 1 gramme is 1/58 × 8.89 = 0.15328 ohm.

Paragraphs (1) and (4) define "volume resistivity" and "mass resistivity" respectively. This may be expressed in other units as follows:—Volume resistivity = 1.7241 microhm-c.m. (or microhms in a cm. cube) at 20 deg. C., = 0.67879 microhm-inch at 20 deg. C. and "mass resistivity" = 875.20 ohms (mile, pound) at 20 deg. C.

In the interests of uniformity, it is to be hoped that the Engineering Standard Committee will adopt the above standards, and will further provide that—

5. The resistance of hard-drawn copper shall be considered 2.7 per cent. greater than that of annealed copper of the same size at the same temperature (*i.e.*, 20 deg. C. or 68 deg. F.).
6. The legal standard wire gauge as fixed by Order in Council, dated August 23rd, 1883, shall be adopted as the standard gauge, as in the existing standards.

In the meantime, it should be noted that the Engineering Standards Committee defines hard-drawn copper wire as wire which does not elongate more than 4 per cent. on a gauge length of 10 in. when broken by tension, and that the standard resistance for it is just 2 per cent. higher than that for annealed wire at 60 deg. F. (15.6 deg. C.).

It may also be noted that the Board of Trade's existing regulations for overhead lines require that the elongation of hard-drawn copper wire will not be less than 2 per cent, in a length of 10 in., so that wires for such lines naturally fall between elongation limits of 2 per cent. and 4 per cent.

The British Engineering Standards for Trolley Wire is contained in Report No. 23, issued in August 1905, but it needs revision in view of the subsequent experience gained in the manufacture of such wires and of the common use of grooved sections of trolley wires.

The testing of annealed copper conductors is very simple, and is confined to gauging the wires with a micrometer gauge and measuring the ohmic resistance, and sometimes to the weighing of samples or coils. In the case of hard-drawn copper, additional tests are necessary to determine:—

1. Tensile strength.
2. Extension as a test of hardness.
3. Limit of proportionality (elastic limit).
4. Absence of brittleness.

Tests (1), (2), and (3) are usually made simultaneously on a specimen which is exactly 10 in. long between the grips of a Dennison, Buckton, Avery or other suitable testing machine. Modern testing machines are arranged so that autographic records of the extension of the wire may be taken, which are sufficiently accurate for commercial work. If, however, *exact* extension measurements are needed, then they must be made carefully by an experienced worker, with an extensometer. In practice, it is found that the actual tensile strength increases in proportion to the diameter, and not to the sectional area, as one would expect, although the tensile strength in tons per square inch increases with a decrease of diameter. After analysing a number of tests made by Mr. Thomas Bolton, Mr. A. P. Trotter found that the tensile strength could be expressed as follows:—

$$T = a - b\,D.$$

Mr. D. R. Pye and other investigators have found from a large number of tests that the value of a is approximately 30,

and that of b is 20, on all sizes of conductors up to 0.5 in. diameter.

It is not, however, sufficient to define the strength of the wire; it is also necessary to have some check on its hardness and absence of brittleness by ascertaining that it does not fall below a stated *minimum* extension per cent. Tests on wires from 0.075 to 0.5 in. diameter show that the minimum extension can be expressed by

$$E = 5\,D.$$

On these results, Mr. Pye has suggested (*Journal of Institute of Metals*, No. 2, 1911, Vol. VI) the following as the basis of a satisfactory definition of hard-drawn copper:—

"Hard-drawn copper, when in the form of circular wires, shall have a tensile strength *not less than* that given by the formula—

$$T = 30 - 20\,D.$$

and an extension per cent. on a marked 10-in. length, including point of fracture, of *not less than* that given by the formula—

$$e = 5 \times D.$$

where in the foregoing formulæ:—

T = tensile strength in tons per sq. inch of original section.
e = extension per cent.
D = diameter of the circular rod in inches.

An examination of the standard figures prepared by the Wire Committee of the American Society for Testing Materials (1909) for wires ranging from 0.04 to 0.46 in. diameter shows that they agree closely with the above specification for strength, while the minimum extension figures agree closely with the formula:—

$$e = 4\sqrt{D}.$$

The Engineering Standards Committee might, therefore, consider the adoption of Mr. Pye's specification on the grounds that—

(*a*) It calls for a high standard which can easily be obtained by the leading manufacturers throughout the world;

(*b*) Tables of the minimum tensile strength and extension per cent. can be prepared for use for all the usual sizes of wires; and

(*c*) It is easily applied to all intermediate sizes.

Test (4) is almost wholly covered by Test (2), and probably could be displaced by it, but the British Post Office and other users specify the following ductility test for wires which range in diameter from 0.0791 to 0.2237 inch:—

"The wire shall be capable of being wrapped in six turns round wire of its own diameter, unwrapped, and again wrapped in six turns round wire of its own diameter in the same direction as the first wrapping, without breaking; and shall be capable of bearing the number of twists set down in the Table without breaking. The twist test will be made as follows:—

"The wire will be gripped by two vices, one of which will be made to revolve at a speed not exceeding one revolution per second. The twists thus given to the wire will be reckoned by means of an ink mark which forms a spiral on the wire during torsion, the full number of twists to be visible between the vices:—

Weight per statute mile.			Approximate equivalent diameter.			Minimum breaking strain.	Minimum number of twists.	Maximum resistance per mile at 60° F. when reduced to standard diameter.	Weight of each piece or coil.	
Required standard.	Minimum.	Maximum.	Required standard.	Minimum	Maximum.				Minimum.	Maximum.
lb.	lb.	lb.	in.	in.	in.	lb.		Standard ohms.	lb.	lb.
800	784	816	0·2237	0·2215	0·2259	2,400	In 3 in. In 6 in. 15	1·0984		
600	588	612	0·1937	0·1918	0·1956	1,800	20	1·4645	100	140
400	392	408	0·1582	0·1566	0·1598	1,250	25	2·1968		
300	294	306	0·1370	0·1356	0·1384	950	30	2·9291		
200	196	204	0·1119	0·1108	0·1130	650	20	4·3936	75	130
150	147	153	0·0969	0·0959	0·0979	490	25	5·8582	75	120
100	98	102	0·0791	0·0783	0·0799	330	30	8·7873		

To show how this works in practice, three standard 600-lb. wires were taken at random and the following results were obtained:—

G.P.O. Specification.	Breaking strain 1,800 lb.	Twists in 6 in. 20 minimum.	Wraps, 6 on, 6 off, 6 on.	Ohms per mile 1·4645
Sample I	1,895 lb.	28	66663	1·4590
„ II	1,880 „	30	666662	1·4540
„ III	1,900 „	28	66664	1·4591

An extraordinary and unexpected result has been that the 600-lb. wire had a breaking strain of 1,850 lb. after 20 twists had been applied, but there was no measurable extension. It would seem that the work done on the wire in twisting had increased its hardness and brittleness until it became useless for any practical purpose.

The General Post Office tests for brittleness give a rough measure of the quality of the wires, and their value lies in the ease with which they can be applied; but it should be noted that the Department does not specify any extension test. It may be stated, however, with considerable confidence, that wire which complies with Mr. Pye's specification will also automatically comply with the Post Office specification. Apart from this, it does not seem clear why a wire which is to be erected and subjected to longitudinal strain only should be tested by wrapping and twisting, and the extension test would seem to be a more scientific way of determining the toughness of the metal. This opinion is confirmed by the action of the Wire Committee of the American Society for Testing Materials in offering explanations of their omission of these wrap and twist tests from their specification for hard-drawn copper wire.

(*To be continued.*)

LEGAL.

Electrical Worker Fined at Tynemouth.

At Tynemouth Police Court, on the 12th inst., George E. Horler, 30, described as an electrical worker, was charged under the Defence of the Realm Regulations with having failed to answer questions on October 26th.

Detective Mason said that, acting on instructions from the Chief Constable, he visited Tynemouth electricity works on October 26th, to see Horler, who was employed there, but the man was absent. He then went to the accused's lodgings, and questioned him. Asked where he was born, accused said he was born at Hull, and, later, said at York. He refused to answer other questions that were put to him, and he was taken to the police station. Having obtained authority, witness searched accused's boxes, and he found a motor and cycling map of the Wembley District of London, a manual of military engineering, and a bank-book. Witness made further inquiries, and found that in the early part of the year Horler went to work with Messrs. Holmes, electrical engineers, at Newcastle-on-Tyne, but left after three days, without notice, and without drawing the wages due to him. The man next worked at Hull as a switchboard attendant for six months, and then secured a situation in the power station of the London and North-Western Railway Co. at Wembley. While there he secured a place at the Tynemouth electricity works, and left Wembley without notice and without drawing his last week's wages.

In reply to Mr. B. C. K. Snagg, who defended, Witness said they had obtained a birth certificate. This was produced, and showed that Horler was born at Yeovil, in Somerset, in 1885, that his father was a native of Somerset, and his mother of Durham.

Mrs. E. F. Green, with whom accused was lodging, spoke to conversations which the accused had with a Mr. Kenway and herself. On one occasion he said he would close down the Tynemouth electricity works. Accused: I did not. Witness added that when Horler came home on October 25th, earlier than usual, he said he had been dismissed. He said that he had burnt out the works, and that they would hear more of it in the morning. Mrs. Green added that accused was always running England down and sticking up for the Germans.

Francis Batey said that he was in charge of the Tynemouth electricity works on the night of October 25th, and Horler was assistant switchboard man. While witness was in the telephone box the lights went out, and on rushing back to the switchboard he found that Horler had been turning the regulator. There was no reason why he should have touched it. Witness re-adjusted it, and told Horler not to interfere with it. Witness went back to the telephone box, and immediately the lights went out again. He then found that, despite his warning, accused had again interfered.

Mr. E. Turnbull, electrical engineer, said he was at home when the lights went very low, and then came back. A few minutes afterwards they went very high and then very low. He at once rang up the works, and from what he was told he gave instructions that Horler must leave the works at once and see him next morning. Horler did not turn up in the morning. Some damage was done and some people were frightened.

Horler, in evidence, denied any malicious intention in connection with the regulator. It was a patent type, which he had never seen before, and he turned it, inadvertently, the wrong way. He told a lie about his birthplace, so that no inquiries might be made at Yeovil to distress his mother, who was old and feeble.

E

Mr. Snagg suggested that the magistrates should dismiss as "trimmings" the evidence as to the alleged conversations, and the incident of the power station.

Mr. T. Young, the presiding magistrate, said they found the accused guilty of not answering questions put to him legally. They did not propose to go into anything else. The offence was a serious one in times like these. Taking into consideration that Horler had been in prison 16 days, they ordered him to pay a fine of £25 and the costs of the witnesses.

Osram Lamp Works, Ltd., *v.* Pope's Electric Lamp Co., Ltd.

This case came before the Court of Appeal, composed of the Master of the Rolls and Lords Justices Bankes and Warrington on November 11th, upon the appeal of the plaintiffs from a judgment of Mr. Justice Joyce, in the Chancery Division, giving judgment for the defendants in the action which was brought against them to restrain the alleged infringement of Letters Patent, No. 23,899 of 1904, granted to Dr. Alexander Just and Franz Hanaman, for "Improvements relating to the manufacture of incandescent electric lamps."

The improvements claimed consisted in making filaments of pure tungsten by mixing finely divided tungsten or its compounds with an organic binding material, forming the filaments from the mixture in the usual manner, and then carbonising them in some cases after dinitration had been effected. The filaments were then raised to a high temperature by passing an electric current through them in an atmosphere of steam and hydrogen, and were rendered uniform or equalised by submitting them to the action of the current in an atmosphere of volatile tungsten compounds in the presence of a quantity of hydrogen. Plaintiffs also, by the action, claimed that the defendants had also infringed Letters Patent (of which they were the owners) granted to Phillip Middleton, Justice in 1906 (No. 18,622) for an "Improved method of providing metallic incandescence bodies for electric glow lamps," but at the trial in the Court below the plaintiffs did not open their case as to this patent.

Defendants contended that they did not infringe, because they did not carbonise the filaments, and did not pass an electric current through them, but heated them in an electrically-heated furnace, and that they did not use an atmosphere of steam and hydrogen, and did not equalise the filaments.

Plaintiffs, however, contended that the purpose of passing the current through the filaments was only to raise them to a high temperature, and that the defendants' heating apparatus was equivalent to the plaintiffs'; plaintiffs also said that the defendants produced steam by the reaction taking place inside the tubes in which the filaments were heated, and so in effect used an atmosphere of steam and hydrogen.

The defence was that the plaintiffs' patent was bad for want of subject-matter and utility, and for insufficiency of directions in the specification; that the idea of making filaments of tungsten was old, and that the only evidence that it was possible to carry out successfully the directions was not to be accepted. Mr. Justice Joyce decided that the plaintiffs' patent was not for making filaments of tungsten, but only for making them by the particular process specified; that the defendants did not use an atmosphere of steam and hydrogen in the sense in which it was used in the plaintiffs' specification, and, further, that the defendants had not been guilty of infringement. His Lordship further held that if it had been necessary to decide the question of validity of the plaintiffs' patent, it was doubtful if the subject-matter and the directions were sufficient. Upon these grounds his Lordship dismissed the action, and from this decision the plaintiffs now appealed.

Mr. A. J. Walter, K.C., Mr. Colefax, K.C., Mr. J. H. Gray, and Mr. Lunge appeared in support of the appeal, and Mr. T. Terrell, K.C., Mr. Hughes, K.C., and Mr. Russell Clarke for the respondents.

Mr. Walter, in opening the case for the appellants, said it was an appeal from a judgment of Mr. Justice Joyce on July 20th, who had dismissed the action on the ground of non-infringement by the defendants. Questions of validity were raised, but not decided by the learned judge. Various issues were raised, some of which were the same as in action tried before Mr. Justice (now Lord Justice) Warrington. That action was brought by the present plaintiffs against the "Z" Electric Lamp Co.

Lord Justice Warrington: I suppose the issue of validity may be raised here?

Mr. Walter: Oh, clearly.

Continuing, the learned counsel said, in 1898 the demand for a metallic filament was a pressing one. Osmium was a very expensive thing, costing about £100 per lb. In 1904 the present invention came along, and it was the first time that anybody had produced a coherent tungsten filament. Since the date of the plaintiffs' patent other patents had been taken out. Before 1904 no method was known by which you could so use tungsten. Messrs. Just and Hanaman discovered that if you took one of the atmospheres by which Welsbach had treated osmium and metals of that group, you could make a filament of tungsten. Defendants had raised several defences. They said first of all that they had not infringed. Then they alleged want of novelty and want of subject matter, insufficiency of directions and want of utility.

The Master of the Rolls: You have opened a very large field Mr. Walter. Would it be possible for us to deal with the question of infringement or non-infringement first?

Mr. Walter replied that he thought that course would be convenient, but he thought it desirable that the Court should have a full statement as to the nature of the plaintiffs' invention.

Continuing, Counsel said that what Welsbach did was to teach the world that certain defined metals could be used for the manufacture of coherent filaments, these metals being osmium and the metals of the platinum group. He taught the world nothing except what would happen with regard to the metals of the platinum group. He thought the evidence of the plaintiffs was to that effect, and no questions were asked of any witness by the defendants at all that that specification had taught the world anything more. Tungsten was a well-known metal, worth only some shillings per lb., whereas osmium cost several sovereigns. At the time of Welsbach's specification tungsten was a well-known metal, and was largely used for hardening steel. Notwithstanding Welsbach knew about tungsten in 1898, it occurred to nobody for six years afterwards to experiment and try to make a coherent tungsten filament by a process which was one of the three processes indicated by Welsbach. Tungsten for the purpose of filaments had been suggested long before Welsbach for electric lighting. It had been suggested as long back as 1889 by Bottom, but all that he had done was to produce an incandescent filament composed of metallic tungsten and carbon in varying proportions.

Continuing his address, Mr. Walter referred to the specification of Siemens & Halske, No. 277, of 1904, and also to Gulcher's specification. He (Counsel) pointed out that Welsbach's experiments did not lead him to suggest that tungsten could advantageously be used for making filaments. Defendants' process consisted in taking a mixture of finely divided tungsten and an oxide of it, mixing it with a carbonaceous binding material, and then squirting the mixture. The filaments so produced were put into an iridium furnace heated by electricity and filled with hydrogen and passed slowly from the cool lower part of the furnace to the hot upper part, and then back to the lower part—steam was formed in the furnace, and the process was in effect that of the plaintiffs. Electricity as used by the plaintiffs had no function other than heating. Counsel also explained the defendants' alternative process before the final heating. By that process it appeared that the defendants put the filaments on holders in a quartz tube heated in an electric furnace to 950° C. and exhausted by an air pump, chemical action successively took place, and hydrogen, steam and carbonic oxide were formed. The filaments were then cooled, heated in air to 220° to oxidise the tungsten, heated again in the quartz tube to 950°, cooled, and finally heated to 850° in hydrogen. He (Counsel) contended that there had been clear infringement by the defendants, and that there was subject-matter in the plaintiffs' invention. Counsel then proceeded to read at great length the evidence given in the Court below.

(To be continued.)

Dexter *v.* Aldershot Urban District Council.

This claim for an injunction to restrain the defendants from working the plant at their electricity works at Laburnham Road in such a way as to cause a nuisance or injury to the plaintiff, was opened in the Chancery Division on Tuesday. We shall report the matter next week.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New Insulator Bracket.

Pole-line brackets of pressed steel have recently been developed by Messrs. Hubbard & Co., of Pittsburg, Pa. The Peirce bracket, as it is called, is said to be of unusually strong construction, and

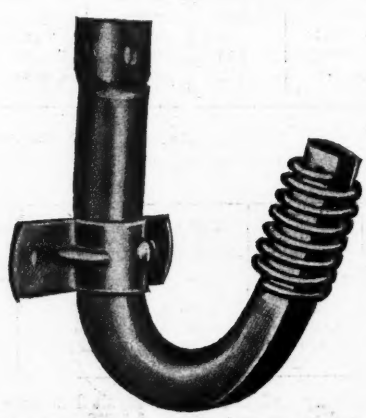


Fig. 1.—Pressed-Steel Bracket with Spring Thread.

is provided with rounded surfaces which cannot scrape the insulation from the wires. The bracket is equipped with a spring thread, as shown in the illustration, which, it is claimed, cannot lock the insulators. The spring thread yields and adjusts itself to the insulator.—*Electrical World.*

Tree Insulator.

In order to prevent damage to shade trees and eliminate dangerous grounds, the insulator shown herewith has been developed for use on city transmission lines. The device consists essentially of two pieces of semi-tubular galvanized iron which

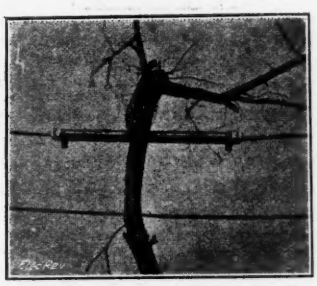


Fig. 2.—Insulator for Protecting Shade Trees.

are fitted together and held in place by circular screw clamps. The ends of the tube are equipped with porcelain insulators as shown. The insulator is being made in lengths of from 1 ft. to 6 ft. When over 1 ft. long, porcelain-mica insulators are inserted in the tube 1 ft. apart. The device is being made by the Frank Ridlon Co., Boston, Mass.—*Electrical World.*

Corrosion-Proof Fittings.

We have received from the St. Helens Cable and Rubber Co., Ltd., of Warrington, samples of their most recent patent corrosion-proof lampholder and ceiling rose. The former, which we illustrate in figs. 3 and 5, consists of an interior fitted with the lamp socket below and wiring terminals above; this is enclosed in a barrel, the upper end of which is closed by a specially formed cap, and the lower end by a screwed gland carrying the shade ring, the gland being adjusted to fit closely over the shoulder of the lamp when in position in the holder. The cap is chambered out to allow for the wiring terminals, the two wires being introduced

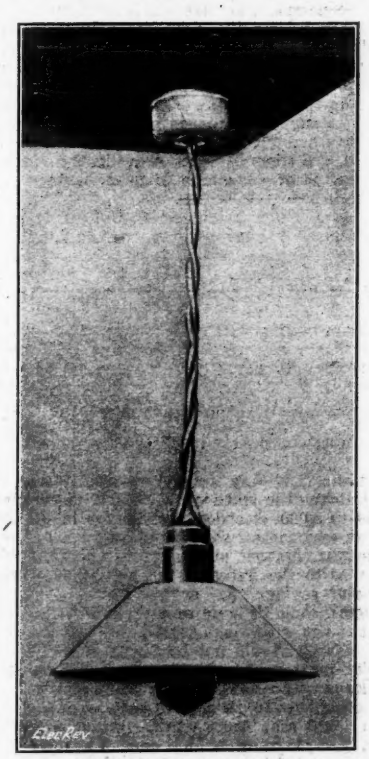


Fig. 3.—Corrosion-proof Lampholder and Ceiling Rose.

through separate holes leading to the bottom of the cap and bent upwards to the terminals; a small screw plug allows of a special fluid compound being introduced, which fills the interior of the cap and completely seals it.

We understand that samples of these lampholders have been tested immersed in double strength battery acid for a period of 20 hours, and after that placed under water with the lamp burning for 24 hours.

The corrosion-proof ceiling rose, figs. 3 and 4, is very similar in principle to the corrosion-proof ceiling type junction box described in our issue of February 12th last, p. 204, but it has the additional advantage that the pendant leads pass down through the centre of the fitting instead of over the side of the sealing cup, and it is secured to the ceiling by three screws instead of one, as shown then.

It may be mentioned that this fitting consists of a porcelain interior provided with internal sealing chambers divided by parti-

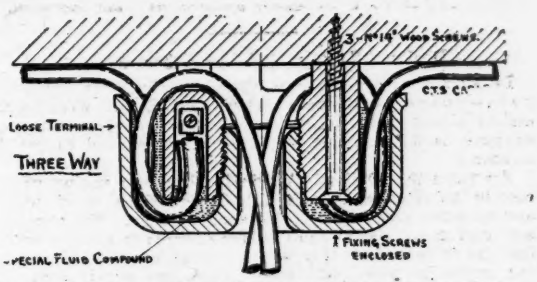


Fig. 4.—Sectional View, Corrosion-proof Ceiling Rose.

tions, to contain the junction terminals between ceiling and pendant wires, and this interior is screwed to the ceiling; a porcelain sealing cup, which is filled with fluid compound, screws over the interior, and the fluid seals the contents against moisture or

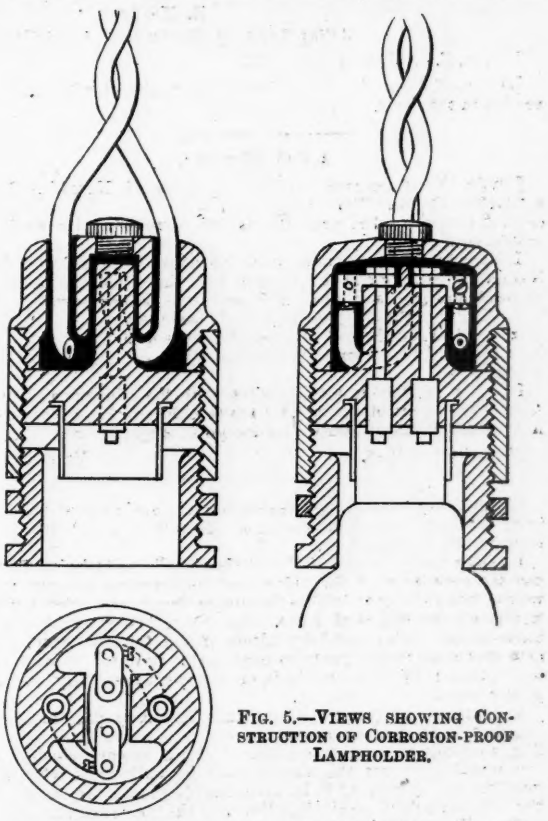


Fig. 5.—Views showing Construction of Corrosion-proof Lampholder.

vapours. The wires are led through the cup to the interior, and pass out through the cup and down through the central hole to the pendant.

Conduit Spacing Support.

We have received from Messrs. Simplex Conduits, Ltd., of Garrison Lane, Birmingham, a mailing card, No. 604, describing the firm's conduit supports, for use on the surface of brick or similar walls where the conduit should be supported free of the

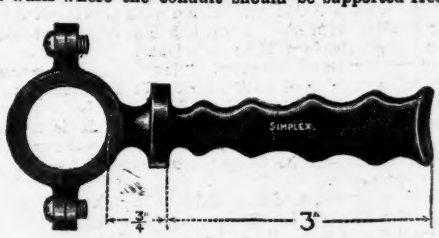


Fig. 6.—Conduit Support.

wall. The rag bolt is intended to be grouted into the wall with Keene's cement up to the shoulder, and the conduit will then be spaced out ¾ in. clear of the wall surface. These supports are made for ½ to 2 in. conduit.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Decimal Coinage and the Metric System.

In all reports coming from abroad dealing with our foreign trade, greater stress than ever is laid upon the fact that the most serious hindrance to the extension of our commerce with metric countries is the retention by us of our antiquated weights and measures.

For years the Decimal Association has been urging without ceasing the adoption by the British Empire of the metric weights and measures and a system of decimal coinage. The country is now very much alive to the need for a thorough awakening from our past trade methods if we are to hope to succeed in the struggle for commerce which will ensue when the war is over. The accomplishment of our aims is therefore hopeful, but if we are to succeed in bringing about this reform, we require the help and co-operation of all who are in favour of our object. I shall be pleased, therefore, to hear from any who are in agreement with us, and will gladly send further particulars of our work if application is sent to the Decimal Association, Finsbury Court, Finsbury Pavement, London, E.C.

E. Merry,
Acting Secretary, The Decimal Association.

London, E.C., *November 10th*, 1915.

[Other letters on this subject have been received too late for insertion in this issue.—EDS. ELEC. REV.]

A.E.G. Meeting.

I note the correspondence in your issue of November 5th, relating to the above, but in spite of this correspondence it is very evident that the Electrical Co. is being supported by English manufacturers.

I have in front of me a price list issued by this firm dated November, 1915, which they have had the effrontery to send through the post, and which I assume has been distributed broadcast. I notice that they claim to hold large stocks of the Osram, Mazda and Wotan lamps. Here we have the names of three firms in the Tungsten Lamp Association who are supporting the Electrical Co.

In view of the repeated claims that the Tungsten Lamp Association is one of German inspiration, the supply of Tungsten Association lamps certainly does not go to disprove such feeling.

November 9th, 1915. **Vigilant.**

"Inquisition" is striking the right note in his letter of the 6th inst. If the movement is to be of benefit to British trade we must have a definite programme.

In spite of the letter of "Anti-Humbug," our technical Press has the confidence of the majority of the electrical industry, and we can look to them to initiate the proper steps to give effect to the wishes of the electrical trade. We can be justly proud of the broad-minded views and lofty ideals of the technical Press, and any movement that hopes to succeed in this matter must work on a clean issue with clean methods, or else we cannot rely on the proper support in the country.

Thousands of our best brains are now abroad, in many cases for the first time, leading a strenuous life in defence of the old flag, adapting all types of machines to the most novel conditions, endeavouring to get the utmost value in work from whatever machine or instrument is in their charge, gaining experience in the severest school, with their lives and the honour of the flag at stake. When these men return at the conclusion of the war, they will be a most formidable barrier to German trade in this country, both because of the invaluable experience gained and by reason of their acquaintance with German methods at close quarters in all their ugliness. The technical Press is in touch with the views of the country, and we hope to see the matter take a more solid form than correspondence.

Union Jack.

We note with pleasure Mr. Marryat's statement in your current issue that the Electrical Contractors' Association has taken action respecting trading with the enemy, but his protest would have had very much greater force if he had given your readers a specific example of the success of its action. "Inquisition" suggests that we should call a meeting of contractors. We are sorry to think a meeting should be required to instil the first principles of patriotism in the ranks of electrical contractors; but if it is necessary, here is a task ready to hand for the E.C.A., and although we are not members, we should be delighted to give the Association all the help in our power.

The E.C.A., moreover, need not confine themselves to the Electrical Co., Ltd.; there is, for example, the Schorch Electrical Co., of Basinghall Street, not a limited company, but an integral part of the German firm. These people, before the war, were busy supplying loom motors, and not only supplied German-made machines, but also imported electrical Huns to wire and fix them. These workmen, together with the general manager, are now interned, but the business is being kept "warm" under the ægis of our benevolent Government.

There are also several firms of contractors and manufacturers with German managers and directors of military age still carrying on business in London. One director, we are informed, actually holds a commission in the German Army.

E. P. Allam & Co.
E. P. ALLAM.

I have delayed replying to the correspondents who have commented on my letter which appeared in the ELECTRICAL REVIEW of October 29th, in the vain hope that there would have been at least a small percentage of the 3,000/5,000 contractors in the Kingdom who would have taken up their own cudgels.

As it is, only one firm has been good enough to show its colours, but I do not forget that several—quite six—have previously written you in the same proper spirit.

I do not retract one single word of what I have written; on the contrary, I have still more reason for knowing that what I have written is fact.

You, Sir, have taken my remarks regarding the technical Press in too personal a manner, although I am glad it has given you the opportunity of such an honest disclaimer. But the fault I find is that you do not as a rule hit out strongly enough. You might remember that it is of very little use to handle such a subject as the one I am trying to arouse interest in, with too much delicacy. At times it is expedient to talk to the gentlemen of Billingsgate in their own language. But I am glad to read how you are improving.

I am glad to see the chivalrous letter of Messrs. Allam & Co. They cannot think that the average contractor is unlike themselves. This thought does them credit, and I would that it were so. I do not deny that there are many firms and individuals like Messrs. Allam, but, in the aggregate, they form but a small proportion of the whole. The very existence at the present time of concerns like the Electrical Co., who live on factoring goods to contractors, is a proof, *ipso facto*, that contractors are behaving unpatriotically by supporting such concerns. Any profits that such merchant factors make must be at the expense of the fools or worse, who deal with them. "They toil not, neither do they spin," but batten on the ignorance or cupidity of their customers. Only two or three firms of contractors have, so far, had the courage or decency to write and disclaim any trading with such concerns. I have failed to notice the name of Mr. Marryat's firm.

It may be taken, therefore, in this case of trading with these fine old British concerns, that "He who is not for us is against us."

Quite apart from the above obvious and logical arguments, and in spite of Mr. Marryat's bluff and mock heroics, it is notorious that the majority in number of electrical contractors in this country are men of very small means, who have no backbone, either in regard to finance, business methods, or chivalry in their trade rivalry. Many of these persons who have barely made a living in the past by buying and selling the cheapest kind of German rubbish, are supporting concerns like the one in question, because they find it of advantage to do so, having in mind past favours and the hope of future ones.

Mr. Marryat admits that trading with the enemy has received drastic treatment at various meetings of the E.C.A. Surely no greater proof of my contention could be produced. It must be borne in mind that the E.C.A. controls only a minority of the contractors of Great Britain. Can Mr. Marryat assure you that the Council of the E.C.A. have taken any definite steps to dissuade the members from trading with such concerns?

The correspondence in your columns this week (November 12th) is very instructive. It would appear therefrom that despite the 10 years' membership of Mr. Marryat on the Council of the E.C.A., the position of the average electrical contractor, in regard to this matter, is somewhat worse that it was, say, 10 years ago. As the advertisements say: "They (the Council) want more Bovril."

Now, Sir, there is a very simple and inexpensive means of proving or disproving the truth of what I have written. There are some 3,000 to 5,000 electrical contractors in Great Britain. It would be an easy matter to put the question before each one in a straightforward manner, and in such a way that there could be no question as to the issue and no hesitation needed as to a plain and honest "yes" or "no" answer.

A circular letter could be sent to each, and the reply (postcard or letter) sent to you with the understanding that the name of the contractor, if desired, should not be divulged. Such a plebiscite would cost for postage and printing some £15 to £20. I am willing to make myself responsible for addressing the envelopes, and will also contribute 10 per cent. of the cost of the postage and printing. No doubt nine other public-spirited men will quickly volunteer, Mr. Marryat being number one. Twenty-one clear days after the last of the list has been sent out, the number of answers received, with the proportion to those sent out, to be published in the next issue of the REVIEW. I shall be delighted to find I must eat the leek, but I have no fear.

As to the personal element—I always try to avoid this if possible, and am sorry Mr. Marryat has introduced it. I do not think it affects this subject in the least, but for Mr. Marryat's information I may say that reasons of a very personal nature prevent me at the moment from disclosing my identity. I am not attempting to sling mud; I am writing very seriously on a subject about which I feel very deeply, and I have nothing to gain directly or indirectly if the contractors of this country do or do not take up the matter in a serious manner. Moreover, I am writing with a little more than average knowledge of the subject.

November 15th, 1915. **Anti-Humbug.**

Noisy Motor-Generator.

In reply to "Troubled" on the above subject in your issue of 12th inst., I had an exactly similar case to deal with about 15 months ago, the only difference being oil-ring bearings instead of ball-bearings.

When the set was tested at the manufacturer's works, the supply was obtained from a polyphase motor-alternator, the motor-generator under these conditions running very smoothly; the set was again tested on site under actual working conditions (supplying D.C. to cinematograph arc), but to our surprise the surging noise which "Troubled" complains of was very noticeable.

After further investigation, it was discovered that the singing was due entirely to electrical causes—the source of supply. In this part of the city the single-phase current was supplied from a reciprocating set, as in most cases of S.P., where the plant was put down in the early days.

The magnetic field of the S.P. motor being an oscillating one against a rotating field in the case of the polyphase motor, the reciprocating motion of the engine is superposed on this oscillating field, giving rise to the surging phenomena, the resultant period of the superposed oscillation synchronising with the natural period of vibration of the revolving parts.

It was found that this trouble only occurred at the high speed, 1,500-1,400 R.P.M. The noise being objectionable, it was decided to put in a six-pole set, giving a synchronous speed of 1,000 R.P.M.

When this set was tested on site, the trouble had entirely disappeared.

D. D. Rayner.

Wolverhampton, *November 15th*, 1915.

[Other letters have been forwarded to our correspondent.—Eds. Elec. Rev.]

Economising on Audits.

At the present time, when we are being instructed to economise in all ways possible, and when legislation can be put through at lightning speed, it seems to me that it would be an opportune time for our Legislature to pass a small Act accepting the audit of a firm of recognised chartered accountants for the accounts of electric supply companies, so as to avoid duplicate auditing, as at present. To many of us the present arrangement seems a farce, and this would certainly be a method of economising without sacrificing efficiency.

Is this matter too commercial for the Institution to deal with or can we look to it to give us a lead?

Urban Electric Supply Co., Ltd.

J. E. Edmundson, *Resident Engineer.*

BUSINESS NOTES.

Bankruptcy Proceedings.—A. F. Hawdon, electrical engineer, Gosforth.—A first dividend of 2s. 6d. in the £ is payable November 22nd, at the Official Receiver's office, 30, Mosley Street, Newcastle-on-Tyne.

J. Wright Dewhurst, electrical engineer, 52, North End Road, Fulham.—The creditors met on Monday, at the London Bankruptcy Court, when a statement was submitted showing debts £152, against assets valued at £24, and Mr. E. Leadam Hough, Senior Official Receiver, reported that the business was commenced by the debtor's father some 15 or 16 years ago, and was taken over by the debtor in August, 1912. He purchased the stock and tools for £38, and carried on the business until October 30th last, when he closed it in consequence of the war. The receiving order was made on the petition of the Sloan Electrical Co., Ltd. In the absence of any proposal the case was left in the hands of the Official Receiver to be wound up in bankruptcy. The following are the principal unsecured creditors, viz.:—

Cockerell Bros.	£20
Harris, B.	33
Langdon-Davies Motor Co.	22
Sloan Electrical Co., Ltd.	51

Tom Arthur Flather, electrical engineers, Leeds.—First and final dividend of 4s. 6d., payable November 24th, at the Official Receiver's office, 24, Bond Street, Leeds.

For Sale.—The borough electrical engineer of St. Helens has for disposal one Babcock & Wilcox water-tube boiler, with superheater and underfeed mechanical stoker; the Urban District Council of Denton has a Mather & Platt turbine pump and 6½ B.H.P. motor, with switchgear and self-starter, for sale. Particulars are given in our advertisement pages.

Board of Trade Inquiries.—Australia.—The representative of a firm of machinery importers and agents in Melbourne, at present in the U.K. who brings a letter of introduction from H.M. Trade Commissioner, Australia (Mr. G. T. Milne), is desirous of making arrangements for the representation in Australia of United Kingdom manufacturers of electrical and other machinery. The name, &c., of the firm can be ascertained on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C.

Liquidation.—Central Wireless Co., Ltd.—A meeting is to be held on December 13th, at 45, Newhall Street, Birmingham, to hear an account of the winding up from the liquidator, Mr. R. B. Earle.

Catalogues and Lists, &c.—The Park Royal Engineering Works, Ltd., of Cumberland Avenue, Park Royal, N.W., have sent us a note pad, with fitting for attachment to the telephone; also a spare refill pad. Friends and customers of the firm can have similar pads by making application to the above address.

Messrs. Dick, Kerr & Co., Ltd., Abchurch Yard, Cannon Street, London, E.C.—Eight-page price list of Britannia metallic-filament lamps. We have also received samples of the Britannia lamp shades that have been issued for use while lighting restrictions are in force. Such shades, which bear an appropriate Britannia design let in in white on a black background, can be obtained on application. The inner side is white, so that the shade is a reflector also.

Messrs. Landis & Gyr, Elgee Works, Stonebridge Park, Willesden, N.W.—Circular of standard scales for wattmeters.

Messrs. Gillespie & Beales, Amberley House, Norfolk Street, W.C.—Illustrated list, showing the "Nilfisk" electric suction cleaners in two types. One of these, type B, is a new model which the firm have recently placed on the market to meet the demands for a cleaner at a medium price, between that of the Broomstick class of cleaner and the largest types.

Messrs. Ferranti, Ltd., Central House, Kingsway, London, W.C.—Twelve-page attractive pamphlet, entitled: "The House Beautiful," and containing illustrations showing the convenient application of Ferranti electric fires in the various parts of the modernly appointed household. Prices are shown. The pamphlet is for circulation among consumers.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—New price list of Osram drawn-wire lamps of standard type, round bulb, spiral-filament type, and Axial type. Also a small folder giving price information regarding the lamps. Both of these lists are supplied over-printed to electrical contractors, dealers, and ironmongers.

We have received from the County of London Electric Supply Co., Ltd., a specimen copy of the illustration which has been designed for use in their electric heating circular announcing the terms on which they hire-out electric fires. It is of quite topical interest, and is certainly a credit both to the artist and to the company.

Book Notices.—"Electric Arc Phenomena." By E. Rasch. Translated by K. Thornberg. London: Constable & Co. Price 8s. 6d. net.

"Handbook of Technical Instruction for Wireless Telegraphists." By J. C. Hawkhead and H. M. Dowsett. London: The Wireless Press, Ltd. Price 3s. 6d. net.

"Scientific Papers of the Bureau of Standards." No. 257. "Note on the Resistance of Radiotelegraphic Antennas." Washington: Government Printing Office.

LIGHTING AND POWER NOTES.

Australia.—The North Sydney (N.S.W.) Council has been informed by the general manager of the city electric light department that the submarine cable ordered in England for the supply of electricity to North Sydney would not be ready for the final tests until early in November, and he was afraid the supply would not be available until February next. An overhead transmission to North Sydney, crossing the Parramatta River, was also being provided, but would not be ready till February.

Additional generating plant has recently been installed at the Ipswich shops of the Queensland railways department, consisting of a 1,000-KW. Willans-Siemens turbo-alternator with condensing plant. The turbine is of the mixed-pressure type, of disk and drum construction, and runs at 3,600 R.P.M.; the alternator supplies two-phase current.

The power house at the new Federal capital, Canberra, has now been equipped, the plant including four Babcock boilers, with chain grates, economisers, and induced-draught plant, &c., supplying steam to two 600-KW. Belliss-Brush generating sets and one 150-KW. Robey-Hall set, with condensing plant, switchgear, and transformers.

The South Brisbane (Queensland) Council has agreed to support the application of the City E.L. Co. for electric lighting powers in the city.—*Commonwealth Engineer.*

Aylesbury.—The U.D.C. has accepted the offer of Lloyds Bank, Ltd., to renew the E.L. loan of £21,233 for another year, the rate of interest to be 5 per cent. for the first three months, and to be reconsidered after that period in view of any rise in the bank rate.

Beckenham.—The U.D.C. has decided to grant a free supply of current to the war hospital supply depôt.

Bradford-on-Avon.—Under the Special Acts (Extension of Time) Act, 1915, the B. of T. has extended the time for making the transfer of the Bradford-on-Avon electric lighting order, 1914, for one year from January 30th, 1916.

Broadstairs.—Price Increase.—The U.D.C. has agreed to pay for a period not exceeding 12 months the increase of 10 per cent. charged for current supplied by the Isle of Thanet Tramway and E.L. Co. A similar advance has been made in the case of private consumers.

Canterbury.—Street Lighting.—Owing to restricted lighting during the past half-year there has been a saving of £578 on the cost of public lighting by electricity. If the restrictions remain in force until March next, the saving for the present half-year will be over £700.

Continental.—Holland.—The Special Commission which was appointed some three years ago to investigate the question of the national supply and use of electric current has concluded its labours. The consumption of current for lighting purposes in the next five years for the whole country is expected to be 84,787,000 kw.-hours per year. The annual consumption of current by the large industries is calculated to amount to 170,850,000 kw.-hours and by the small industries to 12,151,000 kw.-hours. The current needed for agricultural purposes is estimated at 5,660,000 kw.-hours, but a larger amount is considered necessary for the pumps, sluices, &c., peculiar to Holland. The power furnished by windmills, steam engines, motors and various electric stations, requires to be augmented, the first-named by 6,700 kw., and the steam engines, &c., by 18,740 kw. These figures will be largely increased if the work of draining the Zuyder Zee is carried out, in respect of which about 54,000,000 kw.-hours would be required. Electric current is now employed in the working of the Hague to Rotterdam Railway and for eight tramways, but some half-dozen other lines are to be electrified which are now worked by steam power.—*Industria e Invenciones.*

Italy.—The Società Elettrica Calabra Tirrena has been formed at Paola, with a capital of 150,000 lire, for the distribution of electric energy for lighting, power and other purposes.

Darlington.—Loan Application.—The T.C. has decided to make application to the L.G.B. for sanction to the borrowing of £15,600 for generating plant, coal-handling plant, cables and switchgear.

The Electricity Committee recommends that subject to the engineer's report and the receipt of a certificate from the Minister of Munitions, tenders for the supply of a 3,000-kw. turbo-generator and for the condensing plant be accepted.

It was mentioned that the Committee had entered into an agreement with the North-Eastern Railway Co. to supply a 1,700-kw. demand, and an extra 800 kw. was required for the Government demand; in addition 400 kw. was required for Messrs. Summerson's works. The 3,000-kw. generating set ordered last year would probably not be ready until the end of the year, and it was essential the new set should be ordered at once.—*Darlington Times.*

Dodworth.—Prov. Order.—Subject to certain alterations, the application of the Electrical Distribution of Yorkshire for a prov. order is to be supported by the U.D.C.

Durham.—Sanatorium Lighting.—The C.C. has decided to proceed with the electrical installation at the extensions at Hollywood Hall Sanatorium, at an estimated cost of £820.

Edinburgh.—New Power Station.—The Corporation Electric Lighting Committee has agreed to recommend the acceptance of estimates for the sea-water plant of the Portobello electric power station. The amount involved is between £24,000 and £25,000.

Farsley.—The Council has given its consent to the Leeds Corporation providing a bulk supply of electrical energy to Cape Mills, in view of the fact that the premises are partly in Leeds and partly in Farsley, but this concession is without prejudice to the electric lighting powers obtained by the Farsley Council and leased to the Electrical Distribution of Yorkshire, Ltd.

Farnham.—The U.D.C. has decided, in view of the failure of the Farnham Gas and Electricity Co. to supply electrical energy within Hale Ward, that the Hale Lighting Committee be authorised to expend a sum not exceeding £50 in obtaining such technical and legal advice as will enable it to report upon the advisability of powers being sought by the Council to supply energy within the district.

Gravesend.—The T.C. has deferred a suggestion by the engineer that sanction to loans of £1,500 and £1,000 for mains extensions and house services respectively should be applied for. A proposal to supply free current for the X-ray apparatus at the V.A.D. Hospital, provided the cost of the cable is met, has been referred back to the Committee, there being a feeling that, as the cable would cost £75, and as the installation cost has been met by public subscription, the hospital should not be burdened with the cost of the cable.

Greenock.—The Director of Munitions in Scotland has taken up the question of water shortage at the electricity works with the Water Committee, pointing out that certain firms were willing to allow their water to be diverted to the electricity works conditionally on the Committee granting them privileges in the use of metered water. The Committee, after discussion, decided to express no opinion on the matter.

Huddersfield.—Year's Progress.—A report relating to the electricity department of the Corporation during the past year shows that some extensive additions were made to the plant. A new 4,000-kw. turbo-alternator was started last June, and lately the first of the new boilers has been started; new overhead coal bunkers and elevating plant are also being erected. There have been 2,446 h.p. of three-phase motors connected to the mains, bringing the total to 8,706 h.p.; 118 h.p. of additional motors have been added to the single-phase system, bringing the total to 2,628 h.p. These two systems gave a total of 11,334 h.p. of motors. In regard to lamps, the connections during the year equalled 20,368 lamps of 8 c.p., bringing the total of lamps connected to the mains to 292,159. The motors connected during the year are about double the power of those connected in any previous year, and there are applications at present in hand representing a further addition of 3,000 h.p. Extensions of mains have been made to Milnsbridge. Mention is made of the difficulties which have had to be met in regard to the supply and price of coal, and these have been met, in part, by an increase of the charges to consumers. The demand upon the works for electrical energy is so great that it is almost certain that some steps will have to be taken to further increase the generating plant so as to provide the necessary output of energy.

Hindley.—The U.D.C. has intimated its willingness to allow the Wigan Corporation to supply electricity to Messrs. E. Whalley & Co., on the understanding that the Council will undertake the supply when in a position to do so.

Holme.—E.L. Scheme Inaugurated.—The Holme U.D.C. controls one of the smallest urban areas in England, including in its district only 400 inhabitants and 90 houses, the ratable value of the place being £1,660. The villagers have promoted a private company of over 100 subscribers—the largest of which holds £18 worth of shares—with a total capital of £800. They have secured an old mill in the village, and themselves have transformed it into a power station. The electricity scheme has cost £750, and has been carried out by Messrs. J. W. and R. Graham, of Huddersfield, and the opening ceremony took place last Saturday, when Mrs. Mary Howard, aged 89, and the oldest inhabitant of the village, officiated in the chief capacity. Already 56 houses are taking electric current, and there are, in addition, 20 street lamps lighted by electricity.

Leeds.—At the last meeting of the Hunslet B. of G. approval was given to a recommendation of a Special Committee that new and adequate machinery should be provided in the Board's bootmaking and repairing department, and that it should be driven by electric power.

London.—Hackney.—The Finance Committee of the B.C. has decided to amend its application to the L.C.C. for sanction to borrow £2,950, estimated expenditure on house services to March 31st last. The actual expenditure for this period has now been ascertained at £3,031, and it is necessary that the proposed loan should cover the latter sum. The Establishment Committee has recommended the B.C. to make an addition of 2*s.* per week to the ordinary pay of all workmen on the weekly pay roll of the electricity and refuse destructor undertakings, such increase to be regarded as a bonus dependent on abnormal conditions.

Shoreditch.—The B.C. has received the L.C.C.'s sanction to borrow £1,500 for the purposes of the electricity undertaking.

Price Increase.—The South London Electric Supply Corporation will advance its charges for electricity by 9 per cent. from the first quarter of 1916.

Malvern.—The U.D.C. has decided with regard to current supplied to theatres and cinema shows, that provided electricity for the cinema machine is taken off the lighting supply, a discount of 1½d. per unit shall be allowed if the account is paid within 28 days from the date of demand. A similar discount affects current used for stage lighting.

Nuneaton.—Wiring Scheme.—The Electricity Committee of the T.C. has had under consideration details of a scheme to introduce electric light in new property which would not, in the ordinary way, have the light, and the engineer was authorised to carry out installations in six or eight houses through a contractor. The charge to a consumer through a prepayment meter will be fixed, for the present, at 5½d. per unit, the ordinary rate to come into force when the cost of the installation has been repaid.

Sandgate.—Public Lighting.—The Folkestone E.L. Co. has informed the U.D.C. that it cannot allow any further rebate than at the rate of £210 per annum during the total time of extinction of public lighting.

Swinton and Pendlebury.—Bulk Supply.—The U.D.C. has agreed to take steps to extend the present agreement with the Lancashire Electric Power Co., under which electricity is supplied in bulk.

Tunbridge Wells.—Public Lighting.—The T.C. has agreed, owing to restricted lighting, that the cost of street lighting by electricity from May 17th, 1914, to May 31st last, shall be reduced by £1,697. The Council has agreed to the electrical engineer acting as hon. secretary to the local Munitions Committee.

West Bromwich.—Proposed Loan.—The Electricity Committee has decided that application be made to the L.G.B. for sanction to the borrowing of £8,850 for generating plant, owing to the increased demand for power.

The sales of current for the quarter ended September 30th amounted to £5,876, an increase of £1,360, as compared with the corresponding period of last year.

Warminster.—The B. of T. has extended the time for making the transfer of the Warminster electric lighting order, 1914, for one year from January 30th, 1916, under the Special Acts (Extension of Time) Act, 1915.

Wigan.—During the election of Corporation Committees for the ensuing year, Councillor Roscoe expressed the view that it was inadvisable that members of the Gas Committee should serve also on the Electric Light Committee, his reason being that these committees were competitive. Other members expressed disagreement with this view, declaring that the committees were in friendly rivalry, and that it was advantageous that members should be on both committees, because they were then able to compare notes and agree upon questions of policy. The matter was allowed to drop.

Yorkshire.—E.L. Orders.—The Otley U.D.C. has decided to support the application of the Electrical Distribution of Yorkshire, Ltd., for a provisional order for the district; the Sharleston P.C. is holding a special meeting to discuss a similar proposal; while the Penistone U.D.C. desires the insertion of a purchase clause in its case.

TRAMWAY and RAILWAY NOTES.

Ashton.—Tramway Wages.—The Tramways Committee, along with the Stalybridge Joint Tramways Board and the Oldham, Ashton & Hyde Electric Tramways Co., recently made an offer of a ½d. per hour advance in the wages of the tramway men, but this has not been accepted, and the Committee has agreed to the matter being submitted to the Committee on Production.

Birmingham.—Tramway Accident.—On Friday, last week, a workmen's car on the Lozells and Gravelly Hill route overturned, causing the immediate death of one passenger and injuries to 30 others, of whom 11 are seriously injured. Owing to the greasy condition of the rails, following rain, the brakes did not act while the car was going down a hill, and it subsequently crashed into a tramway standard and turned over on its side.

Emergency Traffic Staff.—The volunteer motormen who offered their services to the tramway department, to take the place of those men who have joined the Forces, are receiving training, and it is expected that some of the most proficient will be given charge of cars on the various routes of the city during the next few weeks. About 600 applications have been received, and about 10 per cent. have been dealt with up to the present. The 350 lady conductors of cars are giving every satisfaction, and another 200 are training for similar positions.

Bury.—The storm on Friday last caused damage to the wires on the L. & Y. electric railway between Bury and Holcombe Brook, and on Saturday the trains on the branch were run by steam.

Continental.—Spain.—The inauguration of the electric tramways at Las Palmas on the island of Majorca will probably take place in March next. The date of the inauguration has had to be retarded somewhat on account of the war, as the plant has only been obtained with difficulty.

Portugal.—Railway Conversion.—It is proposed to transform to electric traction the line between Lisbon and Cascaes belonging to the Royal Portuguese Railway Co., a work which has been sanctioned by the Government. The company at first proposed to carry out the work on its own account, but after examination it was decided to throw open to competition the construction of the section and its working on lease. The only practical offer was received from the Estoril Construction Co., which undertook to proceed with the conversion on its own account, on condition that the section was leased to it for 50 years. As rental the sum of 75 contos (£16,800) is to be paid for the first year of working, which represents the maximum net receipts hitherto obtained on this line in any year, and the rental will increase to 80 contos in the succeeding four years, whilst the Portuguese Railway Co. will also participate to the extent of 10 per cent. of the gross receipts in future years.

France.—The *Industrie Electrique* learns that the Orleans, Toulouse, Lyons Railway Co., which had equipped two suburban lines at Lyons with an alternating high-pressure equipment, being the first to make the experiment, has decided to abandon this system and to return to the D.C. system. One of the two lines, the Miribel to Lyons, has already been converted. The newly equipped line receives current at both ends, being supplied by a provisional sub-station at Miribel, pending the installation of a battery with which each end will be finally equipped. The other line, that between Lyons, Meyzieu, Pont de Cheruy and Cremieu, will probably be shortly fitted with similar equipment.

Italy.—Representations have been made to the Italian State Railway Administration by the railway section of the "Pro Turin" Association, urging the completion and extension of electrification on the Piedmontese railway network, and in particular, the early completion of the electrification of the line Turin to Bussoleno is called for, with the laying of a second track in view of the saving of time and expense; also the supply of electric current for the working of the completed section to Modane of the Mount Cenis Railway, and the discontinuance of steam working on the Bardonecchia to Modane section, in the interest of this already installed electric plant. The absence of the co-operation of the engineers of the Paris, Lyons, and Mediterranean Railway is recognised to be a cause of the delay, but the Association seems to think the Italian Railway Administration should proceed, with or without their co-operation, in the interest of the future trade prospects of these regions. The Association also urges action with regard to the line Turin-Pinerolo-Torre Pellice. Either the Administration should take over this line, or give help to the company owning it to complete its conversion to electric working. The Association finds it absurd that on the flat section of this line, from Turin to Pinerolo, electric working has been initiated, whereas steam working is still retained on the other section of Torre Pellice, which is of a mountainous character.

Application has been made for a concession for an electric tramway from Biella to Pollone, a distance of 7·238 km. It is proposed to work the line by continuous current at 750 volts. The estimated cost of the undertaking is put at 572,000 lire. The company working the existing Biella-Oropa tramway will take over its working.

The Società Anonima Orobia, of Lecco, has applied for a concession to construct and work five lines of electric tramways in the city of Lecco and suburbs, of a total length of 7,070 metres. The gauge of the line will be one metre. It is proposed to use continuous current at 1,000 volts pressure, transformed from three-phase current at 40 cycles and 3,300 volts, derived in part from the Orobia's own station and partly from certain supply companies. The equipment of the transformer sub-station will consist of two 300-H.P. motor-generators.

Progress is being made with the construction of the electric railway connecting Turin with Lanzo. Extensive construction works have been required, five tunnels being built, of which four are already finished. Six bridges have had also to be built over the Tesso and the Stura. Further, a 16-arched viaduct and a 200-metre viaduct from Procaria to Ceres, are included in the scheduled works. The last-named is the only undertaking which has not yet been taken in hand.

Glasgow.—Six women tramway drivers have been undergoing training, and last week had a preliminary two days' trial on the street traffic, accompanied in each case by a skilled motorman.

Halifax.—Tramway Extensions.—The T.C. has applied to the B. of T. for an extension of time for the completion of tramways in the borough, Queensbury, Shelf and Brighouse until August 18th, 1917.

Huddersfield.—Tramway Statistics.—Some interesting figures are contained in a report on the working of the Corporation tramways during the year ended September 30th. The total receipts were £124 387 (an increase of £14,630, as compared with the previous year), and included £122,333 receipts from passengers; £1,176 from parcels; and £778 from coal haulage. There was an increase of 140 627 in the car-mileage run, the figure being 2,586,213 car miles (including coal trucks), and the number of passengers carried (23,429 259) represented an increase of 2,253,813 on the figures of a year ago. At present there are 106 cars and two electrically equipped coal trucks in the rolling stock; the total mileage of the tramways is 34.

Hyde.—The Council is to ascertain from the Manchester Corporation on what terms it would provide a through service of cars to Hyde Town Hall; to ask the Stalybridge, Hyde, Mossley and Dukinfield Tramway and Electricity Board to submit any proposals it may have to make as to the user of tramways in Hyde and the terms and conditions of such user; and to ascertain what suggestions the Joint Board has to make with respect to the use of the tramways within the borough.

London.—Women conductors were employed for the first time on the London United Tramways last week; they are to be paid 4s. 6d. a day for a six-day week, with a war bonus of 2s. 6d., making 29s. 6d. a week.

According to the *Times*, there was a shortage of tramway cars in the metropolitan area on Monday, due to the number of drivers and conductors who left the South London depôts to enlist in the Army.

Lowestoft.—Women Conductors.—The employment of female conductors on the tramcars has been sanctioned by the T.C. Four of the employés who have been at the Front have been wounded, one three times.

New Zealand.—According to the *Commonwealth Engineer*, it is now proposed to duplicate the mile and a-half tunnel between Christchurch and Lyttelton, at a cost of £125,000, which would result in the abandonment of the proposed electrification of this line.

Good results have been obtained with a trial petrol-electric coach on a Wellington suburban line, and an endeavour is being made to obtain a sufficiently powerful petrol-electric car, for 3 ft. 6 in. gauge, to draw two large passenger cars up the North Island suburban gradients.

Electric train lighting installations are to be fitted on local stock for trial purposes, with a view to their future use instead of gas on the principal express trains.

Rochdale.—The T.C. has approved the recommendations of the Tramways Committee that the wages of the tramway employés be increased, as mentioned last week.

Wharfedale.—Railless Traction.—Friction seems to have arisen between the Burley-in-Wharfedale District Council and the Leeds Corporation in regard to the railless trolley system in Wharfedale. According to statements made by members of the Burley Council, it is thought that some injustice is being done to the users of the vehicles by making them pay 3d. to travel from Burley to Guiseley and 4d. to Otley, when the railway fares are, in both cases, only 2½d. The Corporation has intimated that it cannot permit any interference with its policy in regard to fares.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—A concession has been granted to Don Ramon Tarrio Demaria for the establishment and working of a public telephone service in the districts of Bernascom, Villa Alba, and Jacinto Arauz, in the Central Pampa Territory, for a period of 30 years.—*Board of Trade Journal.*

Australia.—A charge against the Amalgamated Wireless (Australian), Ltd., E. T. Fisk, C. P. Bartholomew, and H. R. Denison, of trading with the enemy, was part heard in September, at Sydney. It related to the execution of an indenture of licence by which, it was alleged, the Telefunken Co. would have been placed in a strong position with regard to the patent rights of wireless telegraphy throughout Australasia while the war was in progress.

Hull.—Mr. T. Holme, manager of the Hull Corporation Telephone Department, attended a special meeting of the Telephone Committee on Saturday and applied, on his own behalf and on behalf of all the employés of military age, for permission to enlist. It was stated that if all the eligible men enlisted the system would be brought to a standstill; nevertheless, the desired permission was accorded by the Committee.

Italy.—The Consigliore Superiore dei Telefoni has authorised the acquisition by private tender of the following:—10,037 metres of Patterson telephone cable for the city of Piacenza; 68,292 metres of telephone cable for Bologna, and 60,000 metres of rubber-insulated bronze wire. It has also sanctioned the extension of various telephone networks.

Paraguay.—Asuncion, the capital of Paraguay, has been provided with a wireless station, constituting the second military zone. It was opened to public service at the beginning of October.

Spain.—A concession has been granted to the Mancomunidad de Cataluna (Union of Catalona), to install and work an interurban telephone network in the Province of Catalona. The network reverts to the State in 1957.

Uruguay.—The Government has under consideration a proposal for the erection of a high-power wireless station similar to that projected by the owners of the Poulsen patents in Argentina, and likewise presented by them.—*Review of the River Plate.*

Wireless in Territorial Waters.—At East Ham Police Court, on Saturday, Jakob Veenhoven, 43, a Dutch subject, captain of the s.s. *Roepat*, was charged with using on board his ship wireless telegraphy in territorial waters. The defendant was proceeding from the Dutch East Indies with a general cargo to London. The ship had called at Deal and was going round the North Foreland, up the mouth of the Thames, on November 5th. On that morning a naval officer, stationed at Ramsgate, heard the s.s. *Roepat* calling on her wireless Scheveningen, from 8 o'clock until 8.35, when a message was sent in Dutch. There was no evidence that it was anything but a perfectly innocent message. The calls were very loud, and were interfering with Admiralty wireless communications.

The Court imposed the maximum penalty of £10, and allowed £2 2s. costs.—*Times.*

Wireless on Board Ship.—The value of wireless telegraphy to ships is well exemplified in the report of the U.S. Bureau of Navigation for the fiscal year 1915, which shows that 26 vessels leaving American ports met with accidents requiring the use of wireless telegraphy to call assistance. Except in the case of the *Lusitania*, which was torpedoed, the assistance thus rendered resulted in but two lives being lost. Since the period covered by the report the steamship *Sant' Anna*, carrying 1,700 souls, caught fire at sea, but all were saved, and the *Athinai* was entirely destroyed by fire, the passengers and crew, numbering 470, being rescued, in both cases through wireless calls.—*T. and T. Age.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—November 25th. G.N. of Scotland Railway Co. Six or twelve months' supply of telegraph material. Forms of tender from the Stores Superintendent, 80, Guildford Street.

Athy.—December 6th. U.D.C. Tenders are invited for lighting the town with electricity. Particulars from Mr. J. A. Lawler, Town Clerk.

Australia.—December 7th. P.M.G.'s Department (various States). Non-encrusting zincs, carbon and manganese powder, manganese chloride, chloride of ammonia, porous pots (2 in.), outer jars for cells, carbon blocks, resistance boxes of 5,000 ohms, &c. See "Official Notices" October 15th.

December 20th. P.M.G.'s Department, N.S.W. 4,250 telephones (Schedule 454).*

January 5th, 1916. P.M.G.'s Department, Queensland. Copper wire and accessories (Schedule 356). January 26th.—Telephone instruments (Schedule 344).

January 19th, 1916. P.M.G.'s Department, S. Australia. One common multiple switchboard, Telephone Exchange, Adelaide (Schedule 405).

Adelaide.—January 19th. P.M.G. Common-battery switchboard. See "Official Notices" to-day.*

January 26th. Deputy P.M.G. Twenty tons of galvanised-iron wire, 400 lb. to the mile.*

Brisbane.—P.M.G. January 26th.—Galvanised-iron wire. December 1st.—Measuring instruments. January 5th.—Jointing sleeves and copper-clad steel wire. See "Official Notices" to-day.

January 26th. Deputy P.M.G. Telephone instruments, parts and accessories.*

Goulburn.—December 15th. Council. One 200-kw. direct-coupled generating set, gas or steam driven. Specification, 10s., from the Local Government Association, 103 4, Queen Victoria Markets, Sydney, or the Town Clerk.

Sydney.—December 6th. Municipal Council. 33,000-volt outdoor transformers and switchgear. Specifications (10s. 6d.) from Electric Light Department, Town Hall.

December 20th. Metropolitan Board of Water Supply and Sewerage. Three centrifugal pumps and electric motors, each to pump 6,300 gallons per minute, and one to pump 15,100 gallons per minute, together with switchboards, starters, &c., for the pumping station at Marrickville, N.S.W. Deposit £10. Tenders to the Board, at 341, Pitt Street, Sydney, N.S.W.*

January 12th, 1916. N.S.W. Railway and Tramway Department. Two water-tube boilers, &c., for the Zara Street power house, Newcastle. See issue of October 8th for further particulars.

January 31st, 1916. Three electrically-operated railway freight-car transferers, for Jones Bay wharfage, Pyrmont. Particulars from Engineer-in-Chief of the Harbour Trust, Circular Quay.

Melbourne.—December 14th. Deputy P.M.G. Eleven sections of a lamp-signalling trunk-line switchboard, and other material necessary for increasing the equipment of Melbourne Trunk Exchange from 108 to 240 lines. Schedule 1,207.*

January 5th, 1916. Installation of automatic sprinklers and thermostats at Jolimont car-shed. Chief Storekeeper, Railway Offices, Spencer Street, Melbourne.

Perth.—December 8th. 294 accumulators, and power board complete, for P.M.G.'s Dept. See "Official Notices" October 8th.

Canada.—November 23rd. Dominion Government Department of Naval Service, Ottawa. Electric cable and wire for H.M. Canadian dockyards.*

Chatham.—November 24th. T.C. Twelve months' supply of incandescent electric lamps. Specifications from the Borough Surveyor's office, Town Hall.

Enniskillen.—December 1st. Sligo, Leitrim and Northern Counties Railway Co. Twelve months' supply of telegraph materials. Forms of tender from Mr. J. Duff, Secretary's office.

Ilford.—November 23rd. U.D.C. Triple-concentric cable and boxes. See "Official Notices" to-day.

Manchester.—November 23rd. Tramways Committee. Hard-drawn copper trolley wire. Mr. J. M. McElroy, General Manager.

Salford.—November 29th. Manganese steel crossings for the Tramway Department. General Manager, 32, Blackfriars Street.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Aylesbury.—The U.D.C. has decided to accept the tender of Messrs. Johnson & Phillips, Ltd., for a cable for Bicester Road, at £384.

Broadstairs.—Mr. Vernon Hill, Broadstairs, has secured the contract for the electric light installation at the new Christ Church now being erected.

Glasgow.—The Cleansing Committee recommends the acceptance of the offer of Messrs. Woodward & Co. for the supply of carbons, &c., from December to May next.

Great Yarmouth.—The T.C. has accepted the tender of Messrs. Cleeves & Co., London, for 2,000 tons of slack coal and 500 tons of hard steam coal for the electricity works.

London.—The Education Committee has received the following tenders for installing electric light in the Thornfield Road School, Hammersmith :—

James Whitaker & Sons	£421
A. Hawkins & Sons	429
G. Weston & Sons, Ltd.	483

The Committee proposes to accept the first-mentioned tender.

METROPOLITAN WATER BOARD.—The tender of Simplex Conduits, Ltd, has been accepted, at £53, for electric fittings in connection with the installation of the electric light at the Central Buildings, Battersea ; also the tender of the New Phonopore Telephone Co., Ltd., at £108, to supply brass receiver cases with diaphragms, spacing rings, and ebonite ear-pieces.

New Zealand.—The Public Service Stores Department, Wellington, has received tenders for the following supplies :—

20 miles of paper-insulated, lead-covered telephone cable, 26 pairs.—**Turnbull & Jones, Ltd.** (accepted), £2,960 ; Tolley & Son, Ltd., £3,000 ; A. D. Riley & Co., Ltd., £3,020 ; P. R. Baillie & Co., £3,055 ; Richardson, McCabe & Co., Ltd., £3,080 ; Lawrence & Hanson Electric Co., £3,140.

3 miles of paper-insulated, lead-covered telephone cable, 39 pairs.—**Turnbull & Jones, Ltd.** (accepted), £576 ; Tolley & Son, Ltd., £591 ; A. D. Riley & Co., Ltd., £591 ; Richardson, McCabe & Co., Ltd., £591 ; P. R. Baillie & Co., £594 15s. ; Lawrence & Hanson Electric Co., £680.

13 miles of paper-insulated, lead-covered telephone cable, 59 pairs.—**Richardson, McCabe & Co., Ltd.** (accepted), £4,410 ; Turnbull and Jones, Ltd., £4,574 ; Tolley & Son, Ltd., £4,428 ; A. D. Riley & Co., Ltd., £4,446 ; P. R. Baillie & Co., £4,509 ; Lawrence & Hanson Electric Co., £4,572.

8 miles of paper-insulated, lead-covered telephone cable, 78 pairs.—**Turnbull & Jones, Ltd.** (accepted), £1,020 ; Tolley & Son, Ltd., £1,035 ; A. D. Riley & Co., Ltd., £1,041 ; P. R. Baillie & Co., £1,053 ; Richardson, McCabe & Co., Ltd., £1,071 ; Lawrence & Hanson Electric Co., £1,104.

13 miles of paper-insulated, lead-covered telephone cable, 104 pairs.—**Richardson, McCabe & Co., Ltd.** (accepted), £5,408 ; A. D. Riley and Co , Ltd., £5,478 ; Tolley & Son, Ltd., £5,486 ; P. R. Baillie & Co., £5,582 ; Turnbull & Jones, Ltd , £5,616 ; Lawrence & Hanson Electric Co., £5,850.

1 mile of paper-insulated, lead-covered, armoured telephone cable.—**Richardson, McCabe & Co., Ltd.** (accepted), £182 ; Tolley & Son, Ltd., £185 ; Turnbull & Jones, Ltd., £187 ; A. D. Riley & Co., Ltd., £188 ; Lawrence & Hanson Electric Co., £188 ; P. R. Baillie & Co., £189.

15 miles of paper-insulated, lead-covered, armoured telephone cable, 26 pairs.—**A. D. Riley & Co., Ltd.** (accepted), £3,675 ; Tolley & Son, Ltd., £3 645 ; P. R. Baillie & Co., £3,719 5s. ; Richardson, McCabe & Co., Ltd., £3,720 ; Lawrence & Hanson Electric Co., £3,735 ; Turnbull and Jones, Ltd., £3,825.

11 miles of paper-insulated, lead-covered, armoured telephone cable, 52 pairs.—**Lawrence & Hanson Electric Co.** (accepted), £3,982 ; Tolley and Son, Ltd., £4,037 ; A. D. Riley & Co., Ltd , £4,037 ; Turnbull and Jones, Ltd., £4,092 ; P. R. Baillie & Co., £4,118 9s. ; Richardson, McCabe & Co., Ltd., £4,180.

1 mile of paper-insulated, lead-covered, armoured telephone cable, 78 pairs.—**Richardson, McCabe & Co., Ltd.** (accepted), £462 ; A. D. Riley & Co., Ltd., £473 ; Tolley & Son, Ltd , £474 ; P. R. Baillie & Co., £484 ; Turnbull & Jones, Ltd., £490 ; Lawrence & Hanson Electric Co., £505.

7 miles of paper-insulated, lead-covered, armoured telephone cable, 104 pairs.—**A. D. Riley & Co., Ltd.** (accepted), £4,333 ; Richardson, McCabe & Co., Ltd., £4,340 ; Tolley & Son, Ltd., £4,340 ; Turnbull and Jones, Ltd., £4,396 ; P. R. Baillie & Co., £4,419 ; Lawrence & Hanson Electric Co., £4,522.

100 miles of insulated, twin-twisted wire.—**Lawrence & Hanson Electric Co.** (accepted), £1,375 ; Richardson, McCabe & Co., Ltd., £1,387 10s. ; Turnbull & Jones, Ltd., £1,500 ; A. & T. Burt., Ltd., £1,585.

New Zealand Shipping and Commerce.

The Wellington City Council has accepted the tender of the National Electric Co. for transformers, and that of Messrs. Richardson, McCabe & Co. for insulated wire.

Sunderland.—The T.C. on the 10th inst. accepted the following tenders :—

Ferranti, Ltd.—Meters.
E. Cleaton, Rees & Co.—Lubricating oil.

FORTHCOMING EVENTS.

University College, London.—Fridays, November 19th and 26th. At 5 p.m. Third and fourth Lectures on "Electric Heating and Electric Furnaces," by Prof. J. A. Fleming, F.R.S.

Institution of Mechanical Engineers.—Friday, November 19th. At 8 p.m. At Storey's Gate, S.W. Papers on "The Chemical and Mechanical Relations of Iron, Molybdenum, and Carbon," by Prof. J. O. Arnold, F.R.S., and Prof. A. A. Read, and "The Cause and Effect of 'Ghost Lines' in Large Steel Forgings," by Prof. J. O. Arnold, F.R.S.

Greenock Electrical Society.—Saturday, November 20th.—Visit to the Glasgow Sewage Works at Shieldhall.
Friday, November 26th. At 7.45 p.m. At Temperance Institute, 19, West Stewart Street. Paper on "Land Diesel Installations," by Mr. J. Richardson.

Post Office Telephone and Telegraph Society.—Monday, November 22nd. At 6.30 p.m. At the I.E.E., Victoria Embankment. Paper on "Telegraph Experiences in India," by Mr. J. J. Tyrrell.

Illuminating Engineering Society.—Tuesday, November 23rd. At 8 p.m. At the Royal Society of Arts, John Street, Adelphi. Discussion on the first Report of the Departmental Committee on Lighting in Factories and Workshops. Opener, Mr. Leon Gaster.

Royal Society of Arts.—Wednesday, November 24th. At 4.30 p.m. At John Street, Adelphi. Paper on "Constantinople, Ancient and Modern," by Sir Edwin Pears.

Institution of Electrical Engineers.—Thursday, November 25th. At 8 pm. At Victoria Embankment, W.C. Paper on "Some Difficulties of Design of High Speed Generators," by Prof. A. B. Field.
(Birmingham Local Section).—Wednesday, November 24th. At 7 p.m. At the University, Edmund Street. Paper on "Some Difficulties of Design of High-Speed Generators," by Prof. A. B. Field.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, November 26th. At 7.30 p.m. At Bolbec Hall, Newcastle. General Meeting.

Manchester Association of Engineers.—Saturday, November 27th. At Grand Hotel, Aytoun Street. Paper on "Design and Application of Ballbearings," by Mr. H. J. Moysey.

NEWS OF PRISONERS OF WAR AT RUHLEBEN.

WE have received the following interesting communication too late for inclusion in our "Correspondence" columns :—

The following extract from a letter I have received from an engineering friend interned as a civil prisoner of war at Ruhleben, Berlin, may be of interest to some of your readers :—

"There are a number of fellows here in our trade, for instance :
Dreyfus, of Brunnenstrasse (A.E.G.).
Trinks, Jepson & Mendelsohn, of Adnil.
Hotopf, Wuest & Ball, of Morganite.
Kindersley, Stokes, North, Scholes, and Dewhurst, of Mather and Platt.
Graham and Lucas, from Tudors.
Kapp, son of Dr. Gisbert Kapp.
Heather and Beurle, late of Vicfalco.
Plowman (A.E.G.), back from Mexico.
Swale, from Mannheim.
Swift, Clement, Rodger, Lane, and Pink, formerly with Siemens, Stafford.
Cooper, of Mirrlees, Watson.
Murray, late of Worthingtons.
Copping, of Blackmans.
Spencer, Nicholson, and Roberts, of Heap & Digby.
Johnson, A E.G. (formerly Siemens-Schuckert).
Jenkins, formerly of the Westinghouse.
Saul and Messent, formerly with the Brush.
Kemp, Ibbetsen, Upward, Squire, Burgoyne, Hecht, Nicolls, and Klein, of A.E G.
C. W. Hatt, of Duisburg.
Lamb, formerly of Richardsons, Westgarth ; and many others.

"My time has been spent largely in loafing, reading the paper, and discussing how long we shall be here. Interned civilians other than those of the engineering profession seem to be singularly incapable of logical thought or honest reasoning, and, where two or three are gathered together, you may be sure that they are belching forth the most blithering optimistic bilge. I am afraid I shall emerge with impaired faculties of reasoning and discussion, but wonderfully developed powers of invective and repartee. Nevertheless, it is a vulgar fallacy to suppose that time is not easily killed. Washing up and other domestic functions can be made, with skill, to last from one meal to the next. As a matter of fact, too, I am attending six course of lectures by first-rate men on various subjects.

"The Ruhleben Camp School does marvels with the facilities at its disposal, and teaches almost every subject and language imaginable, including even Chinese and nigger dialects. Then there are the Banking, Science, Technical, and Marine Engineering circles, which hold profitable discussions. Kemp holds forth on turbines, Ibbetsen on India, Heather on gold-mining, Jenkins on rotaries, Copping on fans, and Lane on patent law before the technical circle, and some of the Marine people's evenings have been most excellent even for the laity. They had a fine evening of breakdown anecdotes and a lecture on gyroscopes by Venables, but their general desire seems to be for lectures on electricity by landsmen. U—— seems to lead a life of dignified leisure, B—— wields tools for the alleged purpose of putting his sleeping box in order, while they both scrape fiddles intermittently. I—— is a budding "Chef," L——, I——, J—— and N—— wear out deck chairs during the greater part of the day, though J——, L—— and U—— have taken to boxing. S—— has made an electric clock out of meat tins, and W——, I fancy, runs a young Exchange and Mart."

My correspondent never fails to enlarge on the pleasure extracted from letters from home, and I venture to suggest that those of your readers who may find the names of any of their friends in the above list might spare a few minutes to write them cheering letters from time to time, selecting their subject matter, of course, with due consideration for the feelings of the Censors, British and German. They will probably not receive replies, as the restrictions on outgoing letters at Ruhleben are somewhat rigorous, but the knowledge of the pleasure that they are giving should be ample compensation. The correct form of address is :—

A. B. Smith, Esq.,
Engländerlager,
Ruhleben,
Spandau.

British Civil Prisoner of War,
Interned in Germany.
c/o General Post Office,
Mount Pleasant,
London, E.C.

Baracke No. ——
Box No. ——

The correct "Baracke" and "Box" numbers can, of course, only be obtained after correspondents have got into touch with their interned friends. I understand that though it is not essential to give the Baracke and Box numbers, their omission causes a certain amount of delay in delivery at Ruhleben.

Letters should be posted in unsealed envelopes, and they do not require a stamp. The letter itself should bear the full address of the recipient, as given on the left-hand side above, and also the full address of the sender,

SYMPATHISER.

NOTES.

Electric Lorries?—"Unable to purchase horses under £110 each, the Shoreditch Council is considering the advisability of purchasing motor lorries."—*Times.*

Alderman Sentenced.—According to the *Times*, Alderman James Hodgson Rodgers, chairman of the Newcastle Corporation Tramways, has been sentenced to 12 months' imprisonment in the second division for misappropriating moneys of the Tyneside Bank, Ltd., of which he was manager and trustee.

The Generators.—Owing to the war, this Society will not carry out its full programme this year, but in order to meet the wishes of a great majority of the members, the Boosters have arranged for one dinner only, in order to keep the Society together. It will be held at the Trocadero Restaurant at 6.15 p.m. for 6.30 on Friday, December 3rd. Mr. Victor Marmont has charge of the arrangements.

Renewing Lapsed Policies.—In the City of London Court, on Friday, before his Honour Judge Rentoul, K.C., C. E. Heath & Co., Ltd., insurance brokers, 3 and 4, Royal Exchange Buildings, E.C., made a claim against Mr. C. R. Belling, Derby Road, Edmonton, for £10 0s. 3d., premium on a policy of insurance effected.

Mr. Gamble, plaintiffs' solicitor, said that the policy was to insure the defendant against claims under the Workmen's Compensation Act. Defendant had been insured, and the policy lapsed on September 9th. By an oversight it had not been renewed, and in March last defendant telephoned the plaintiffs and said a claim was going to be made upon him for an accident, he being under the impression that the policy was still in existence. It was pointed out that the policy had lapsed, and plaintiffs offered either to issue a new policy at once from that day and to give no attention to the claim which the defendant said had been raised against him, or to renew the policy as from the previous September, and to deal with the claim on the defendant's behalf. Defendant said he would rather the policy was renewed as from the previous September, and that had been done, the premium for which was now sued for.

Judge Rentoul said he thought if a policy was not renewed it lapsed as a matter of course.

Mr. Gamble pointed out that that was so, unless as an act of grace plaintiffs chose to renew the policy and to date it back to the time when the renewal premium should have been paid. Plaintiffs were simply carrying out the business on behalf of the Excess Insurance Co.

Judge Rentoul said that the plaintiffs were backed up by a document which defendant had accepted. He must find for the plaintiffs, with costs.

War Munitions Cases.—At a sitting of the Oldham Munitions Tribunal, last week, Walter Thomas, a foreman in the switch department of Messrs. Ferranti, Ltd., Hollinwood, applied for a leaving certificate. He declared that, although the firm were engaged on munition work, he himself was not actually working on munitions, and he desired a leaving certificate because he had had the offer of a post to take supervision of a shell factory. He was a skilled engineer, and had the experience to qualify him for the position offered. In view of the country's urgent need of munitions, he contended that his abilities were not at present being used to the greatest advantage, but when he applied to the firm for his release it was refused.—For the firm, Mr. Thomas said that for the past six weeks the applicant had been substantially employed on munition work.—The applicant said that he had been engaged on switchgear, and that was not munitions work. Moreover, there was no difference in the work he was now doing and that he was doing prior to the war.—The Chairman (Mr. W. Sellars) said that Sec. 3 of the Munitions Act referred, in addition to direct munitions, to the making of substances or articles for war purposes.—The applicant said his contention was that switchgear work did not come under the description of articles used in war. Some of the switches he had made, he alleged, were for private firms.—Mr. Whittaker put in a list of firms to whom the firm had supplied switchgears, and said that practically all those named were engaged in the manufacture of munitions of war.—The Chairman said he and his colleagues were satisfied that the applicant had been employed substantially on munitions work, and refused the certificate.

At the same Court, Frederick Jones, of 12, George Street, Dukinfield, a chemical plumber in the employ of the Tudor Accumulator Co., Dukinfield, applied for a certificate to enable him to take up munition work at Queensferry. On behalf of the firm, it was stated that they had been engaged on Post Office contracts in connection with telephone exchanges and in making batteries for ambulance trains. The firm was now a controlled establishment. For the making of lead boxes and lead linings chemical plumbers were necessary, and owing to enlistments the number of chemical plumbers employed by the firm had been reduced from 13 to nine.—The Chairman said he was doubtful whether Post Office work could be called munition work, and, personally, he would say that ambulance train work was not munition work also. He had been instructed, however, that ambulances were articles used for war purposes, and therefore came within the scope of Sec. 3 of the Act.—It was admitted that up to a week prior to the application the applicant had not been engaged on munitions work, and the Chairman said the certificate would be granted.

L.C.C. Electrical Employés: War Wages.—The L.C.C. Highways Committee considers that the increased rates of pay under the Award of August 11th, 1915, should be paid to the men in the electrical section of the tramways department, and recommends:—

That the rate of pay of wiremen in the electrical section of the tramways department engaged on wiring tramway depôts be increased from 10d. to 10½d. an hour.

That wiremen in the electrical section of the tramways department engaged on wiring tramway depôts be granted an advance of ½d. an hour in addition to the increase specified in the foregoing resolution: that wiremen's labourers in the electrical section engaged on wiring tramway depôts be granted a *pro rata* advance; and that such advances be regarded as war wages, and recognised as due to, and dependent on, the existence of the abnormal conditions prevailing in consequence of the war.

The General Purposes Committee of the L.C.C. recommends that the rates of pay of the undermentioned skilled staff at the Thames tunnels shall be as follows:—

Blackwall Tunnel.

	Weekly rate of pay.
Leading wireman and fitter	45s. 6d. and emoluments valued at 18s. a week.
Electrical wireman and fitter	42s. 6d.
Switchboard attendants (perm. and temp.)	42s. 6d.

Greenwich Tunnel.

Leading machinery attendant	52s. 6d.
Relief and shift engineer (temporary)	45s. 6d.
Electrical fitter	42s. 6d.

Rotherhithe Tunnel.

Leading electrical fitter and machinery attendant	52s. 6d., rising to 56s. 6d., and 8s. in lieu of rent.
Electrical fitters	45s. 6d. and 42s. 6d.
Relief electrical fitter and motor pump attendant	39s. 6d., rising to 42s. 6d.

Woolwich Tunnel.

Leading electrical hand	45s. 6d.
Wiremen (permanent and temporary)	42s. 6d.
Switchboard attendant and electrical fitter (temporary)	42s. 6d.

The Government and Inventions.—A letter has been addressed by the Comptroller of Munitions Inventions to the Institution of Electrical Engineers, drawing attention to the fact that the department, which was recently constituted by the Minister of Munitions for the purpose of dealing with ideas, suggestions, and inventions for appliances in connection with the prosecution of warfare on land, has been authorised by him to receive projects of this nature, or any matters appertaining thereto. An advisory panel, appointed by the Minister, of scientific and other experts, a number of whom are members of the Institution, is assisting in the task of dealing with the large number of cases that have been received, every one of which is given consideration by the panel. They are glad to consider also suggestions with regard to simplification and improvements either in the manufacture or in the materials of existing munitions, or, indeed, in any other respect. The Institution is invited to make known to its members, as widely as possible, the existence and functions of the department.

Dr. Macnamara, replying to a question in Parliament recently, stated that the Admiralty Board of Inventions had received proposals from some 8,000 inventors, many of whom had sent in several different proposals. The proportion of possibly useful inventions was small.

Electrically-heated Soldiers.—It is reported from Austria that a method of weaving electric heating wires into soldiers' pants and connecting the garments with a battery at from 100 to 500 metres distance has been devised by an electrical engineer. It is claimed that the current can be regulated, and that any number of soldiers in the trenches can be kept warm simultaneously. Electric carpets and bed-warmers are quite practical and useful devices, and there is no insuperable difficulty in carrying out this proposal, extraordinary as it may appear at first sight. Complications would arise, however, if the men were stationed in a flooded trench!

A Kite and a Transmission Line.—On a three-phase, 11,000-volt transmission line on Long Island, considerable trouble was experienced from the frequent opening of the oil switches at both ends, apparently caused by momentary short-circuits. This trouble always occurred on windy days, which led to the belief on the part of the maintenance crew that something was swinging into the line. A careful inspection of the whole line failed to disclose any tree branches or other objects that could possibly touch the conductors, and it was purely by accident that the real cause of disturbance was later discovered. It consisted of two small boys and a kite with a picture-wire tail. Two of the linemen noticed the boys in a vacant lot through which the line passed, and stopped a minute to watch them get their kite up. Once in the air the kite was manœuvred toward the line by the boys, and when directly over the wires the boys cut the string, causing the kite to drag its wire tail over the conductors, short-circuiting two. The fireworks which resulted were greeted with howls of delight from the boys, but after persuasion of a most practical character from the linemen, the young Franklins decided to seek safer fields for flying their kite.—*Electrical World.*

Institution and Lecture Notes.—Royal Society of Arts.—At the opening meeting of the Session, held on Wednesday afternoon, Dr. Dugald Clerk, F.R.S., delivered an address on "English and German Methods Contrasted." In the list of future events are the following:—"The Economic Development of Russia," by Mr. Leslie Urquhart; and four Fothergill lectures on "Vibrations, Waves, and Resonance," by Dr. J. Erskine-Murray (May 1st, 8th, 15th and 22nd).

The Royal Society.—The following is a list of officers recommended by the President and Council of the Royal Society for election into the Council for the year 1916 at the anniversary meeting on November 30th:—

President.—Sir Joseph J. Thomson.
Treasurer.—Sir A. B. Kempe.
Secretaries.—Prof. Arthur Schuster and Mr. W. B. Hardy.
Foreign Secretary.—Mr. D. H. Scott.

Other members of the Council include Dr. Dugald Clerk, Sir William Crookes, Prof. R. Meldola, and Mr. Richard Threlfall.

Junior Institution of Engineers.—In a paper read on Monday, at Manchester, Mr. E. Dinsdale Phillips expressed the opinion that electric tramways will be replaced by motor-'buses, and that only the immense capital interests involved delay this. According to the *Manchester Evening Chronicle*, in the discussion which followed, Mr. Phillips's contention was not upheld.

The Faraday Society.—At the annual general meeting of the Society, held on October 19th, the following officers and members of Council were elected to serve for the year 1915-16:—

President: Sir Robert Hadfield, F.R.S.

Vice-Presidents: Prof. K. Birkeland, Bertram Blount, W. R. Bousfield, K.C., Prof. F. G. Donnan, F.R.S., Dr. Eugene Haanel, Prof. A. K. Huntington, Dr. T. Martin Lowry, F.R.S.

Treasurer: F. Mollwo Perkin, Ph.D.

Council: W. R. Cooper, Dr. C. H. Desch, Dr. J. A. Harker, F.R.S., Emil Hatschek, Cosmo Johns, Prof. Alfred W. Porter, F.R.S., E. H. Rayner, A. G. Salamon, Dr. G. Senter, Cav. Magg. E. Stassano.

The Report of the Council states that although the Society's activities were seriously affected by the war, it was found possible to hold four meetings in the period under review, at which 27 papers were read.

The Institute of Metals.—Prof. W. H. Bragg, who (jointly with his son) has just been awarded the Nobel prize for Physics, is to deliver the 1916 May Lecture before the Institute of Metals, and is now devoting attention to the structure of metal crystals as revealed by X-rays; it is expected that he will have an important pronouncement to make on this subject. Non-ferrous metals being of such enormous importance in the production of munitions, it is not surprising to learn that the Institute of Metals (which takes within its purview all metals except iron and steel) is very closely concerned with the production of the metal articles required for the successful prosecution of the war, and is in daily touch with many of the munition factories throughout the country, and with certain Government departments requiring metallurgical information. Large shipments of the *Journal* of the Institute, in which are recorded the latest scientific methods of dealing with the non-ferrous metals, are being dispatched to Japan and the United States for use in works engaged in producing munitions for the Allies. Copies can be purchased by non-members from the offices of the Institute. The war activity in the metal industries tends strongly to reinforce the membership of the Institute, and a ballot for the election of new members has, therefore, been arranged for December 15th. Those wishing to join the Institute should at once write for particulars to Mr. G. Shaw Scott, M.Sc., Secretary, Caxton House, S.W.

North-East Coast Institution of Engineers and Shipbuilders.—The report of the Council for the year ended July 31st, 1915, shows that the membership numbered 1,159, a net increase of 48. The average attendance at meetings was 260. The accounts showed a balance of income over expenditure of £222, and the "general capital and endowment fund" stood at £7,372.

Nobel Prizes.—The Swedish Royal Academy of Science has awarded the Nobel Prize for Physics for 1914 to Prof. M. van Laue, of Frankfort University, for the discovery of the diffraction of X-rays in crystals.

The Academy has decided that the Nobel Prize for Physics for 1915 be divided between Prof. W. H. Bragg, of University College, London, and his son, Mr. W. L. Bragg, of Cambridge, for their researches into the relation of crystals and X-rays.

Volunteer Notes.—Engineering Institutions' Volunteer Corps.—The first meeting of the General Committee of this body took place on Friday last, when there were present Mr. Alexander Ross (Pres. Inst.C.E.), Prof. Unwin (Pres. I.Mech.E.), Mr. C. P. Sparks (Pres. I.E.E.), Sir John Snell, Sir John Gavey, Dr. Tudsbery, Mr. Highfield, Colonel Le Rossignol, R.E., Major Henrici, R.E., Captain Sankey, R.E., Mr. L. B. Atkinson, Lieut.-Colonel C. B. Clay, V.D., Commandant, Mr. E. G. Fleming, Adjutant.

The meeting was the occasion of some enthusiasm, and an Executive Committee was formed, consisting of Sir John Snell (retiring President of the I.E.E.), as chairman, Sir Maurice Fitzmaurice, C.M.G. (a Vice-President of the Inst.C.E.), Colonel Le Rossignol, R.E., Lieut.-Colonel C. B. Clay, Mr. L. B. Atkinson, hon. secretary and treasurer, Mr. Fleming, and a representative of the Institution of Mechanical Engineers, to be nominated by the President.

The report of the Commandant as to the progress of the Corps was most encouraging. To this report he added that an arrangement had been made for sharing headquarters with the 4th Battalion City of London Regiment (Architects' Corps). The premises comprise a spacious drill hall and the necessary offices for mess rooms, common room, orderly room, canteen, &c. Through the kindness of Mr. A. Campbell Swinton, F.R.S., the Corps has received a present from Messrs. Crompton & Co. of a new Admiralty pattern searchlight, of which it is justifiably proud. This is being erected on the premises of the London Electrical Engineers (T.F.), where the necessary instruction will be given. Several men have already qualified in this branch, and parties are engaged each week-end on important work in connection with the defence of London. Under these auspicious circumstances, and with these comfortable and excellent premises for headquarters, the Corps should prove attractive to all suitable men who wish to serve their country.

The Corps will only accept as new members those who are over military age, or disqualified by reasons of health, or who are engaged on war work, and who are not allowed by the Government on that account to enlist in the Forces, but whose training in this Corps would fit them to take part in the defence of the country in the event of a raid by the enemy, or any other emergency; and would also fit them to volunteer as trained men for service overseas if such a necessity arose at a later period in the war. Good men are acceptable whether members of the Engineering Institutions or not.

Orders for week commencing November 22nd, 1915, by Colonel C. B. Clay, V.D., Commanding:—

Drills, 5.25 to 7.25; 7.25 to 8.25 p.m.

Saturday, November 20th.—Uniform Parade, 3 p.m.

Monday, November 22nd.—Sections 1 and 2, Technical; Sections 3 and 4, Squad, Signalling Section and Recruits.

Tuesday, November 23rd.—School of Arms with Architects' Corps, 6 to 8 p.m.

Thursday, November 25th.—Sections 1 and 2 and Signalling Section, Shooting.

Friday, November 26th.—Sections 3 and 4, Technical; Sections 1 and 2, Squad, Signalling Section and Recruits.

Sections for Technical Parade at Headquarters, London Electrical Engineers, 46, Regency Street.

Sections for Shooting Parade at the Miniature Range.

Unless otherwise ordered, all Parades at Chester House.

The opening meeting of the new Headquarters will be held on Wednesday, December 1st, 6.30 p.m. All members should make a special point of attending in uniform.

E. G. Fleming,
Acting Adjutant and Company Commander.

3rd Batt. (Old Boys) Central London Regiment (Volunteers).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, November 18th, 1915:—

Week-end Parades.—Saturday.—The Battalion will parade at Baker Street Station at 2.30 p.m., and proceed by train to Willesden Green Station, where they will alight. North London and Blackheath Platoons, under the command of Mr. Marples, will proceed to Hendon under special instructions issued to that officer. A, B, C and D Companies, under the command of Mr. King, will march via road south of Metropolitan Railway to Neasden, and thence to bridge over Brent stream on Kingsbury Lane.

Sergt.-Major's Parade. Handling of Arms, 5.30 to 6.30 p.m., at Wembley Camp.

Sunday.—The Battalion will parade at Liverpool Street Station at 8.55 a.m. and proceed by train for Entrenching, returning to London about 6 p.m.

The Quartermaster will make the necessary arrangements for Lunch.

Instruction Class.—The Instruction Class which is being held for members of the Corps takes place at the Yeomanry Hall, Henry Street, on Mondays and Fridays, at 5.30 p.m., and not as previously arranged.

Musketry.—Saturday next, the 30th inst., there will be shooting at both Acton and Bisley Ranges, as usual. Members proceeding to Acton must parade there at 2 p.m. punctually. Those shooting at Bisley must report themselves to Sergeant Cotter at the barrier of No. 9 Platform, Waterloo Station, at 12.45 p.m.

Tuesday, November 23rd.—Shooting at Acton, as usual, at 2 p.m.

A. G. Joiner, *Major and Adjutant*, O.B.C.

Legal.—Pembroke U.D.C. *v.* The Diesel Engine Co.—In the King's Bench Division of the Irish High Court, Mr. Justice Kenny gave liberty to the Pembroke (Co. Dublin) Urban Council to serve out of the jurisdiction a writ of summons against the Diesel Engine Co., claiming damages for breach of contract in the erection for £2,977 of an engine for generating electric current, together with all accessories, including cable connections and switchboard alterations. Plaintiffs alleged that the engine was defective in design and construction. The company was stated to be in voluntary liquidation, with Sir W. B. Peat as liquidator, upon whom service was directed to be made.

Electric Power Stations to be "Controlled" Establishments?—In the House of Commons, on Wednesday, a member asked whether the Minister of Munitions intended asking Parliament for powers to make electric power stations controlled establishments, on the ground that they were essential to munitions work. In reply, it was stated that the matter would be dealt with in a Bill shortly to be placed before Parliament.

America and Export Trade.—A Reuter dispatch from Washington states a canvass of American manufacturers, producers, exporters, and others interested in the foreign trade has been undertaken by the Federal Trade Commission in an effort to secure a "broad referendum on the advisability of export combinations." It is announced that agents will be sent abroad to study conditions on the spot. The Commission will also receive assistance from the Department of State through United States Consuls, and from the Department of Commerce through the Commercial Attachés.

The Hughes Induction Balance.—We have already mentioned the use of the Hughes induction balance in military hospitals for localising metallic projectiles; hitherto this application has been confined to the exterior of the body. M. A. de la Baume Pluvinel has carried it a step further by mounting a tiny coil on the tip of the surgeon's finger, so that in exploring the interior of a wound the user is guided by the sound towards the foreign object, and is thus enabled to find the best direction in which to cut down upon it.

Appointments Vacant.—Generating engineers (£3), assistants (£2), for the Hackney B.C. electricity department; station superintendent (£150) for the Walthamstow U.D.C. electricity department. Particulars are given in our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Swinton and Pendlebury U.D.C. has consented to Mr. H. C. BUSBRIDGE, electrical engineer, joining the Forces on terms granted to other employés who have enlisted.

Mr. H. A. BARRACLOUGH, generating engineer at the Hackney B.C. electricity works, has resigned his appointment.

General.—Mr. WM. T. TAYLOR, of Burnley, who, as our readers know, has been for some years connected with Mexican and South American hydro-electric schemes, has been gazetted captain in the Loyal North Lancashire Regiment, a military engineering unit.

The King has granted to Prof. F. P. PURVIS, of the College of Engineering of the Tokio Imperial University, licence and authority to wear the Insignia of the Third Class of the Order of the Sacred Treasure conferred upon him by the Emperor of Japan in recognition of valuable services rendered by him.

Alderman G. J. ALLEN, J.P., has been re-elected chairman of the Croydon Corporation Tramways Committee for 1915-16, and Councillor A. A. THOMSON has been elected vice-chairman.

Alderman G. H. ROBINSON has been elected chairman of the Bradford City Council Electricity Committee, and Councillor J. HALEY vice-chairman.

Councillor HUGH LUPTON has been appointed chairman of the Electricity Committee of the Leeds Corporation, and Alderman R. A. SMITHSON has been appointed chairman of the Tramway Committee, with Alderman H. BROWN vice-chairman.

Councillor CYRIL M. VINCENT, the new Mayor of Oxford, was chairman of the Tramways Committee when the question of adopting an electrical system of traction was first considered by the Council.

Alderman G. WEEKS, of Messrs. G. Weeks & Sons, electricians, has been appointed Deputy-Mayor of Bromley (Kent).

The Birmingham City Council have re-elected Alderman JEPHCOTT chairman of the Electricity Supply Committee.

Mr. J. W. LAWTON has been elected chairman of the Huddersfield Town Council Electricity Committee, with Alderman MARSLAND vice-chairman; and Alderman ASTON chairman and Mr. E. H. SELLERS vice-chairman of the Tramway Committee.

Councillor W. J. STAPLETON has been elected chairman and Councillor H. A. MANGER vice-chairman of the Electricity Committee of the Hackney B.C. for the ensuing year.

Alderman BOWES and Alderman Dr. CHAPMAN have been re-elected chairman and deputy-chairman respectively of the Manchester Tramways Committee; and Councillor DAGNALL and Alderman WALKER have been elected chairman and deputy-chairman of the Electricity Committee.

A number of municipal bodies in Lancashire have elected their committee chairmen for the ensuing year. The following are among the appointments:—*Wigan.*—Electric Light Committee: Ald. J. T. GRIMSHAW, chairman; Ald. A. HIGHAM, vice-chairman. Tramways Committee: Ald. R. T. FLETCHER, chairman; and Coun. J. WALKDEN, vice-chairman. *Accrington.*—Electricity and Tramways Committee: Ald. HIGHAM, chairman, and Coun. MORLEY vice-chairman. *Bolton.*—Electricity Committee: Ald. LONGWORTH chairman, and Coun. COOPER vice-chairman. Tramways: Ald. MILES chairman, and Coun. P. HIGSON vice-chairman. *Haslingden.*—Tramways and Electricity Committee: Coun. WADDINGTON chairman, and Coun. HAWORTH vice-chairman. *Burnley.*—Electricity Committee: Ald. GREY chairman, and Coun. T. W. HARGREAVES vice-chairman. Tramways Committee: Coun. E. HEAP chairman, and Coun. IRVING vice-chairman.

Coun. W. M. WIGGINS, chairman of the Middleton Electricity Committee, was last week re-elected Mayor of the Borough and elevated to the aldermanic bench.

Roll of Honour.—Private HAROLD HORNBROOK, of the 6th Battalion Manchester Regiment, who was previously reported missing, and is now officially reported killed in action at the Dardanelles, was 21 years of age, and prior to the outbreak of war was in the employ of Messrs. Eckstein, Heap & Co., Ltd., of Salford.

Captain P. M. MOON, 4th Black Watch, has been wounded. He left for the Front about five weeks ago. Prior to the war he was in the service of Messrs. Balfour, Beattie & Co., London, as an engineer.

Corporal JAS. JONES, of the 2nd Worcestershire Regiment, who is officially reported missing in France, was prior to the war engaged with the Kidderminster Electric Light Co.

Sapper J. E. HUGHES, one of the victims in the sinking by collision off the Dardanelles of H.M.S. *Hythe*, was before enlistment in the 3rd Kent Field Co., Royal Engineers, on the staff of the Corporation electricity works at Tunbridge Wells.

Gunner W. A. BILLINGHAM, of the Royal Field Artillery, lately with the British Thomson-Houston Co., Ltd., of Rugby, is unofficially reported to have been killed in action on October 21st. He was 22 years of age, and joined his regiment soon after the outbreak of war.

Private ROBERT ALFRED SULLIVAN, of the 10th Battalion Royal Fusiliers (City of London Regiment), who has been killed by shell fire in France whilst endeavouring to save the life of a comrade, was formerly engaged at Charlton with Messrs. Johnson & Phillips, Ltd., and was later an electrician with the City & South London Railway Co.

The D.S.O. has been conferred upon Major B. I. ROLLING, R.E., for services rendered in Gallipoli. Major Rolling, who at the commencement of the war was a lieutenant, is the Igranic Electric Co.'s Glasgow manager, but since the war began his place at Glasgow has been filled by Mr. J. H. Enion, of the firm's London office.

Private BOULT, of the Grenadier Guards, and formerly with Messrs. Siemens, of Stafford, has been killed in action.

Sapper GEO. FILEWOOD, of the 3rd Kent Field Company, Royal Engineers, reported lost by the sinking off the Dardanelles of H.M.S. *Hythe*, had been trained as an electrical engineer with Messrs. G. A. Cross, Ltd., of Tunbridge Wells.

Obituary.—Mr. C. E. MOORE.—The death has taken place of Mr. Chas. Edward Moore, for 20 years in business as an electrician in Silver Street, Doncaster. He was 45 years of age.

MR. H. BARNES.—The death occurred on November 9th, at the Middlesex Hospital, London, where he had been under treatment for some time, of Mr. Harry Barnes, electrician, Chatham. Deceased, who was 44 years of age, had been in business in High Street for a number of years.

MR. W. B. KINGSFORD, chairman of the West India and Panama Telegraph Co., Ltd., passed away on Tuesday, aged 74 years.

Will.—Lieut. T. L. BAINBRIDGE, of Eshott Hall, Felton, described as an electrical engineer in the firm of Swan, Hunter & Wigham-Richardson, who was killed in April last, left £32,443.

NEW COMPANIES REGISTERED.

W. Sanders and Co. (1915), Ltd. (142,057).—This company was registered on November 5th, with a capital of £2,000 in £1 shares, to take over the business of an electrician, metal worker, mechanical engineer, and manufacturer, carried on by L. G. Russell, at 7, Oxford Street, Digbeth, Birmingham. The subscribers (with one share each) are: L. G. Russell, The Cottage, Gravelly Hill North, Birmingham, brassfounder; Mrs. L. Russell, The Cottage, Gravelly Hill North, Birmingham; W. Sanders, 35, Lyndon Road, Olton, Warwick, engineer; A. E. Skidmore, 55, Newhall Street, Birmingham, chartered accountant; G. P. Locker, 71, Temple Row, Birmingham, solicitor. Private company. The number of directors is not to be less than two or more than five; the first are L. G. Russell (permanent director and chairman), Lucy Russell, and W. Sanders. Secretary: Lucy Russell. Registered office: 7, Oxford Street, Digbeth, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Hexham and District Electric Supply Co., Ltd.—Capital, £30,000 in £5 shares. Return dated May 17th, 1915. 1,521 shares taken up; £7,605 paid. Mortgages and charges: £7,350.

Hydro-Electric Power and Public Services Trust, Ltd. (121,598).—Capital, £500,000 in £5 shares. Return dated December 31st, 1914 (filed November 3rd, 1915). Seven shares taken up; nothing called up. Mortgages and charges: Nil.

L. J. Healing and Co., Ltd. (97,137).—Capital, £100,000 in £10 shares (5,000 pref. and 5,000 defd.). Return dated October 11th, 1915. 1,301 pref. and 5,000 defd. shares taken up; £10 per share called up on 1,301; £13,010 paid; £50,000 considered as paid on 5,000 shares. Mortgages and charges: Nil.

Manaos Tramways and Light Co., Ltd. (101,081).—Capital, £900,000 in £1 shares. Return dated September 14th, 1915. All shares taken up; £100 paid; £899,900 considered as paid. Mortgages and charges: £899,900.

Marconi International Marine Communication Co., Ltd. (65,759).—Capital, £350,000 in £1 shares. Return dated July 21st, 1915. 306,084 shares taken up; £201,084 paid; £105,000 considered as paid. Mortgages and charges: £121,880.

Fredk. Jones and Co., Ltd. (110,247).—Capital, £15,000 in £1 shares. Return dated September 17th, 1915. All shares taken up; £7 paid; £14,993 considered as paid. Mortgages and charges: Nil.

London Electrical Trading Co., Ltd.—Issue on November 8th, 1915, of £600 debs., part of a series of which particulars have already been filed.

Electric and General Investment Co., Ltd. (31,506).—Capital, £201,500 in 20,000 ord. shares of £5 each, 40,000 defd. shares of 1s. each, and 19,900 pref. shares of £5 each. Return dated August 10th, 1915. All shares taken up; £1 per share called up on the ord., 1s. per share on the defd., and £5 per share on the pref.; £121,500 paid. Mortgages and charges: £27,813 10s.

Llangollen and District Electric Light and Power Co., Ltd. (75,384).—Capital, £6,000 in 3,500 ord. and 2,500 pref. shares of £1 each. Return dated September 21st, 1915. 2,114 shares taken up; £2,110 15s. paid; leaving £3 5s. in arrears. Mortgages and charges: £2,800.

Electro-Mechanical Brake Co., Ltd. (98,276).—Capital, £30,000 in 2,500 pref. and 27,500 ord. shares of £1 each. Return dated August 12th, 1915. 987 pref. and 17,317 ord. shares taken up; £1 per share called up on 987 pref. and 11,282 ord.; £12,269 paid; £6,035 considered as paid on 6,035 ord. Mortgages and charges: £7,500.

Edmundson's Electricity Corporation, Ltd. (52,013).—Capital, £640,000 in 80,000 ord. shares of £3 each, 40,000 cum. pref. shares of £5 each, and 40,000 non-cum. pref. shares of £5 each. Return dated July 22nd, 1915. All shares taken up; £600,400 paid on 66,800 ord., 40,000 cum. pref., and 40,000 non-cum. pref.; £39,600 considered as paid on 13,200 ord. Mortgages and charges: £467,683.

Brimsdown Lamp Works, Ltd. (101,306).—Capital, £5,000 in 5s. shares. Return dated September 29th, 1915. 12,580 shares taken up; £855 10s. paid on 4,292, leaving £217 10s. in arrears; £2,072 considered as paid on 8,288. Mortgages and charges: £40,000.

Evershed and Vignoles, Ltd. (43,206).—Capital, £30,000 in £10 shares. Return dated July 9th, 1915. All shares taken up; £30,000 paid. Mortgages and charges: £15,000.

Henley's (South Africa) Telegraph Works, Ltd. (77,781).—Capital, £2,000 in £1 shares. Return dated September 10th, 1915. All shares taken up; £2,000 paid. Mortgages and charges: Nil.

Cryselco, Ltd. (58,218).—Capital, £15,000 in £1 shares. Return dated July 8th (filed August 5th), 1915. All shares taken up; £10,007 paid; £4,993 considered as paid. Mortgages and charges: £8,800.

Lancashire Electrical Engineering Co., Ltd. (56,992).—Capital, £5,000 in £1 shares. Return dated June 25th (filed July 21st), 1915. 1,879 shares taken up; £50 paid; £1,829 considered as paid. Mortgages and charges: Nil.

Lancashire Power Construction Co., Ltd. (77,202).—Capital, £300,000 in £10 shares (18,000 "A" and 12,000 "B"). Return dated June 24th, 1915. 18,000 "A" and 11,836 "B" shares taken up; £283,360 paid; £15,000 considered as paid. Mortgages and charges: £300,000.

International Dowsing Electric Heating and Appliances Co., Ltd. (83,693).—Capital, £20,000 in £1 shares. Return dated December 31st, 1914 (filed August 11th, 1915). 18,107 shares taken up; nothing called up on 7 shares; £18,100 considered as paid. Mortgages and charges: Nil.

Salford Electrical Instruments, Ltd. (112,599).—Capital, £20,000 in 10,000 pref. and 10,000 ord. shares of £1 each. Return dated September 29th, 1915. All shares taken up; £10,000 paid; £10,000 considered as paid. Mortgages and charges: Nil.

W. R. Sykes Interlocking Signal Co., Ltd.—Capital, £50,000 in 87,500 "A" and 12,500 "B" shares of 10s. each. Return dated October 6th, 1915. 42,297 "A" and 12,500 "B" shares taken up; 3s. 9d. per share called up on 42,297 "A"; £7,936 18s. 9d. paid, including £6 5s. in advance of calls; £6,250 (10s. per share) considered as paid on 12,500 "B" shares, and £10,574 5s. (5s. per share) on 42,297 "A." Mortgages and charges: £13,000.

Carville Site and Power Co., Ltd.—Issue on October 29th, 1915, of £10,000 debs., part of a series of which particulars have already been filed.

Maxim Lamp Works, Ltd. (108,013).—Debenture dated October 18th, 1915, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Imperial United Lamp Co., Ltd.

Malaga Electricity Co., Ltd. (48,076).—Capital, £57,000 in 10,000 ord. shares of £5 each and 7,000 defd. shares of £1 each. Return dated September 24th, 1915. All shares taken up. £50,000 paid; £7,000 considered as paid. Mortgages and charges: £34,131.

CITY NOTES.

Cape Electric Tramways, Ltd.

The annual meeting was held on November 10th at the offices, London Wall Buildings, E.C. Mr. Ludwig Breitmeyer, who presided, said that their financial year began on July 1st last year, so that practically during the whole of the period covered by the accounts the war had been proceeding in Europe and other parts of the world. South Africa had not escaped either, but had been more fortunate inasmuch as the rebellion was soon suppressed, and the expedition for the conquest of German South-West Africa was brought to a speedy and victorious conclusion. Both these two signal successes had quickly restored public confidence, and the operations of the company during the year were not affected as a whole in an adverse manner. On the contrary, the tramways had maintained the same ratio of their steady progress experienced since the last four or five years, and had carried 21,680,070 passengers, earning £206,123, as against 20,886,146 passengers, earning £200,409, in the preceding year, an increase of 793,924 passengers, and £5,714 in receipts. The net profit earned in South Africa on the year's operations was £86,332, against £81,794 in 1913-14, an increase of £4,538. In arriving at the satisfactory result shown in the balance sheet they had had to contend against a considerable increase in certain items of expenditure, entirely due to causes created by the war. For instance, allowances had been made to employés who had enlisted and gone on active service; a war bonus had been granted to the remaining employés, and all supplies, owing to the rise in prices, had cost more, and it had only been by the exercise of the most rigid economy in every direction that the satisfactory results shown in the accounts had been achieved. It was unwise in times like these to prophesy about the future of the undertaking; difficulties must be dealt with as they arose, and it was perhaps quite unnecessary to anticipate any falling off in their profits. At present the commercial and agricultural outlook in South Africa was very bright, but it was impossible to tell what the aftermath of the war might bring forth. Expenditure was undoubtedly further on the up-grade; on the other hand, any marked increase in the traffics was not probable under prevailing conditions. Although he thought they would be able to maintain the present dividend, further increases were problematical. Of course, they never knew what might happen, but for himself he took a very rosy view of the position at the Cape.

Mr. W. B. Rommel seconded the motion, which was carried unanimously.

West India & Panama Telegraph Co., Ltd.

Sir A. F. King presided, in the absence of Mr. Kingsford through illness, on November 10th, at Winchester House, E.C., over the annual meeting. He said that in addressing them at the meeting in May, the Chairman referred to the unusual conditions under which they were obliged by force of circumstances to carry on their enterprise, and mentioned that, in order to comply with the requirements of the Home and Colonial Governments, it had been necessary to keep their stations open day and night, instead of merely during the ordinary business hours of normal times. This incurred considerable outlay, and this additional outlay, together with the increased cost of the more than usually lengthy bulletin news, was reflected in the accounts presented. Supplying the Colonies daily with a free bulletin of news had been found by them at all times to be a burdensome and costly operation. Nevertheless, they had thought it right to give, during the war, a much more extensive bulletin. The additional expenditure under these two items amounted to over £7,000. It would be observed, however, that, as a partial set-off to this extra cost of working, the expenses attending the maintenance of cables were, fortunately, much below average. He said fortunately because, but for this circumstance, the half-year's profits would have been considerably less than the balance of £9,229 shown in the revenue account. As regarded the increase in the expenses of their stations, the principal item being salaries, wages and overtime, nearly the whole of this increase was due to the Government requirements to which he had already alluded. When the special circumstances which they were now rendering to the Government were no longer necessary, it was their intention to apply to the authorities for such refund in respect of the overtime as they might deem reasonable. The increase in the cost of renewal of instruments was exceptional, and not necessarily of a recurring nature.

Mr. H. W. Birks seconded.

Mr. S. P. Adams said he had read that a Marconi station had been established at St. Lucia, and he would like to know if it was in connection with the company or opposed to them, and if it would affect their income.

The Chairman said, so far as he understood, the work of the wireless station would not interfere with the work of the company in any way.

The motion was then carried, and subsequently a vote of thanks was accorded the board and the staff.

Western Telegraph Co., Ltd.

Sir J. Wolfe Barry, K.C.B., the chairman, presided, on November 10th, over the annual meeting, held at Electra House, E.C. He said that the message receipts afforded an additional revenue of nearly £74,000 for the period under review, which included eleven months of war, with its resultant stoppage, in the case of the company, of telegraphic traffic with Belgium, Germany, and Austria. The closing of these sources of revenue had, however, so far been compensated by increased earnings due to the obligatory use of plain language enforced by the several Governments under whom they worked. These restrictions were latterly modified, permission having been given in the early part of this year for the use of certain well-known codes with South American countries, which had been much appreciated by the telegraphing public. Congestion of lines beyond the company's system necessitated the suspension on August 5th last year of "deferred" and "week-end" telegrams. The former were re-introduced on October 1st, 1914, and advantage was quickly taken of the restoration of this facility. No damage to the company's cables had been experienced in consequence of the war. The sections in North Brazilian waters were interrupted by normal circumstances for four months, and owing to the exceptional con-

ditions then and there prevailing their cable-repairing steamer was unable to attempt their restoration until March last. Communication during the interruption was, however, maintained with the Northern States of Brazil by the Brazilian Government landlines. The general expenses showed a decrease of nearly £9,000, principally due to three causes, the first being the occupation of their own offices and staff quarters at Buenos Aires and Montevideo, thus effecting a considerable saving under the read of rent. The second was their inability, owing to the war, to obtain the usual annual supply of forms and stationery until after the close of the financial year. The third cause was the fall in the value of the Brazilian milreis, which affected all their payments in that currency. There was also the very considerable decrease of over £40,000 in the cost of the maintenance of the cables, but income-tax was higher by close on £15,000. He felt sure that the shareholders would endorse the action of the directors in subscribing to the war relief funds. The balance carried forward was considerably larger than usual, but their message revenue for the current year since July 1st last, showed a decrease of over £25,000, and it was not yet known whether and to what extent the proposed taxation of profits would affect the company. He might mention that very great difficulty had been experienced in restraining the younger members amongst their technically trained staff from joining the fighting forces of the Empire, but they had, with few exceptions, accepted the ruling of the Army Council that they were best serving their country, being specially trained men, with technical knowledge and experience, in remaining at their posts and carrying on the work of State and commercial telegraphic communications. A letter was recently received from the War Office stating that the Council fully realised the importance of the work on which the employés of the company were engaged, and appreciated the efforts which were being made by them in the present emergency. The Council wished the staff to know that it was fully recognised that they, in carrying out their important duties promptly and efficiently, were doing their duty for their King and country equally with those who had joined the Army for service in the field.

Sir J. Denison-Pender, K.C.M.G., seconded the motion, which was carried without discussion.

Amazon Telegraph Co., Ltd.

Mr. Geo. Keith (chairman and managing director) presided over the annual meeting, on Tuesday, at the offices, 42, Old Board Street, E.C. He said that he regretted that the revenue of the business fell very short of what it was last year, and, notwithstanding the very substantial reduction made in the maintenance and working expenditure, they were unable to pay any dividend. The Amazon rubber trade, upon which their business mainly depended, continued very dull and depressed during the year. The low price of rubber further restricted its collection, and there was a decrease in the year's crop of about 12 per cent., which, coming after the falling off of the year before, seriously crippled trade generally on the Amazon, and their business suffered badly in consequence. The traffic receipts showed a decrease of £24,771, due to the falling off of the traffic transmitted over their cables and to the lower exchange. Interest brought in £296 less, and the total revenue, including the subsidy and transfer fees, came out at £57,933, or £24,818 less than the previous year. On the other hand, the expenditure showed a large decrease, which reflected great credit on Mr. Nosworthy, their general manager, and the staff, who exercised every possible economy in the working and maintenance of the cables. The station expenses had been reduced by £3,738, due to the lower exchange and other reductions in the various charges. The expenses attending maintenance of cable showed the large reduction of £11,233, due to less cable having been used during the year, and to the smaller vessel, *Ramos*, having done the cable repairs in the place of the larger vessel, *Viking*, which was laid up practically during the whole year. The other charges were less, and altogether the year's working expenses amounted to £34,939, or £17,221 less than they were last year. After meeting the working expenses and providing £22,888 for the year's debenture interest and sinking fund, there remained a balance of £107, making the amount to be carried forward £5,947, as compared with £5,840 brought in from last year's accounts. Altogether, considering the crisis through which Brazil was passing, and the increased difficulty in getting accounts collected, he thought the figures shown in the balance sheet were not unsatisfactory. As regarded the present year, business generally on the Amazon still continued anything but bright, and there was little prospect of improvement while the war lasted. The lower exchange value of the currency had lately been helping matters somewhat by increasing currency value of the rubber, whilst owing to lack of employment currency wages had so far not risen, but, rather, fallen. This gain in the currency price over the cost of production was acting in some measure as compensation for the excessive export duties which continued to handicap the Amazon rubber industry. This over-taxation should evidently be largely reduced, if not abolished, for, surely, it could not be in the interest of Brazil to paralyse its rubber interests by over-taxation. The economic conditions in the Amazon appeared to be gradually improving. A good deal of cereal planting was being done up-river, and the people should become more and more self-supporting and less dependent on imported supplies. The new crop, which would soon be coming down river, was expected to be larger than last year, and this should lead to increased activity and better business on the Amazon.

Mr. E. B. Ellice-Clark seconded the motion, and the report was carried without discussion.

Drake & Gorham, Ltd.

Mr. Bernard Drake presided at the annual meeting, held at Westminster, on November 11th. He said that £811 had been paid out of profits to the 62 members who were serving their country. In addition to this, fees had been paid in full to two directors, one of whom, Lieut. Carver, was at the Dardanelles. Out of profits, £1,194 was provided to cover depreciation on investments, and £555 for income-tax, as against £67 last year. Economies had been effected in several directions, without which a loss for the year would have been inevitable, especially in view of the disappointing results of the Manchester office, where the installation profits were less than a third of those for the previous year. The amount of work in hand at the close of the year was largely in excess of the previous year's record, and included some important installations. Amongst these might be mentioned a complete generating station for the United Alkali Co., which would contain three turbo-generating sets, each of 1,000 kw., and one of 250 kw., or a total of, say, 4,700 h.p. This plant would include Babcock and Wilcox boilers, Parsons geared turbines, condensers, superheaters, and all modern improvements, and would, it was hoped, lead to further work of the same class. It was to be used for electrolytic work in connection with urgent war requirements. They had also large contracts for the Cotton Powder and other powder companies, in connection with which they had made a special study of the requirements, for the Lord Wandsworth Institution, and the new buildings of the Horticultural Society at Wisley. Ten camps and military hospitals had been, or were being, fitted with light and power, as well as an aeroplane factory. The Queen's Hotel, Birmingham, was being lit for the L. & N.-W. Railway, and lighting contracts for Messrs. W. G. Armstrong, Whitworth and Co., Ltd., Lever Bros., Joseph Crosfield & Sons, and Topham, Jones & Railton, as well as a lengthy list of other installation contracts were carried out during the year. The wholesale department had sustained a severe loss in the death of its capable assistant manager, Mr. F. H. Gooch, who was killed at Vermelle after serving for eight months at the front with the Cameron Highlanders. The restriction of lighting and the absence of new building work had naturally affected the results, but, in spite of this, the net profit was slightly above that of the previous year. Attention was being paid to the lighting requirements of munition and other factories engaged in Government work. Owing to the shortage of carbons caused by the war, there had been a large demand for half-watt lamps with specially-designed fittings to replace arc lamps. They had manufactured complete switchboards for H.M. Office of Works, to be used at Windsor Castle, the Houses of Parliament, and elsewhere; also for corporations, power companies, and others. The shortage of capable labour had caused considerable inconvenience in the works. The use of commercial lorries and delivery vans propelled by electric accumulators had been extended during the year, and vehicles had been supplied to the Liverpool Corporation, the Corporation of Bury, Sir W. G. Armstrong, Whitworth & Co., Ltd., Messrs. Greenall, Whitley & Co., and the Blackpool Industrial Co-operative Society. Subject to their acceptance of deferred payment, they had the offer of several corporation orders. Considering the fact that one of their principal departments, viz., that connected with country-house lighting, had been so seriously affected by the war, he thought it was a cause for congratulation that they had been able to adjust themselves to the altered conditions and to show a small profit. This had been largely due to the ungrudging loyalty of the office staff, who had willingly undertaken the work of absentees by working long hours.

Mr. John Forbes seconded the adoption of the report, and the motion was adopted.

Berlin Electricity Works Co.

As the whole undertaking in the German capital of the Berlin Electricity Works Co. passed into the possession of the City Council on October 1st, the report of the directors for the year ended with June 30th, 1915, represents the final statement which will be made in as far as the Berlin works and system are concerned, the intervening three months coming within the new financial year under the fresh arrangements made for maintaining the activity of the company in other directions. The report states that the continued existence of the company was assured. The results of liquidation according to the existing reserve funds, to the accumulation of which close limits had been drawn through the participation in the profits by the city, would not have approximately corresponded to the quotations for the shares, although these had been influenced for years past more by the prospective expiration of the concession than by the receipts from the sale of electrical energy. Though it was by no means certain a year ago that the capital invested in the Berlin works would be released, the company was able, thanks to its intimate relations with the A.E.G. group, to secure extensive lignite coalfields at Golpa and Zschornewitz, which were held at its disposal with-

out the payment of any intermediate profits, and which were originally intended to be the means of furnishing cheap current for Berlin and environs. It had, however, been ascertained in the event of the City of Berlin not deciding to accept the proposed distant supply, that the possession of extensive coalfields would render possible the production of current at so low a rate that the supply to industrial undertakings, whose existence depended upon the cost of current, appeared to be assured. That had proved to be the case. The Bavarian Nitrogen Works Co., for instance, had undertaken to purchase 500,000,000 KW-hours for a period of 15 years, with the right of extension of the agreement, from the Electro Works Co., which the Berlin Electricity Co. had formed to work the coalfields in question. In the case of the exercise of the right granted to the Bavarian Co. to withdraw from the agreement at the end of five years, arrangements had been made for the payment of adequate compensation by the latter. A contract had also been concluded with the Electro-Saltpeter Works Co., of Zschornewitz, for the annual delivery of 240,000,000 KW.-hours, and the supply would begin in the spring of 1916. The area of the coalfields had been enlarged by the purchase of the majority of the shares in the Leopold Mine, which adjoined the fields of the Electro Works Co.

The City of Berlin, subject to the completion of the accounts, paid to the company the sum of £6,150,000 on October 1st. Out of this amount had to be redeemed an open debt of £574,000, together with the payment of the dividend and the City's share in the profits for 1914-15. The purchase price also served for the acquisition of shares for £197,000 in the Leopold Mine and shares for £250,000 in the Elektro Works Co., to which the Berlin Co. was granting the funds for the erection of the great power station at Zschornewitz, and the company also defrayed out of the price shares for £370,000 in the Electricity Supply Co., which had been acquired for the purpose by the Zurich Bank for Electrical Enterprises. The details of these transactions and of the balance remaining would be set forth in the accounts for 1915-16. The unity of administration with the A.E.G. would be maintained with the consent of the boards of both companies, and with the alterations necessitated under the changed circumstances. In connection with the recent interchange of the Berlin Electricity Co.'s shares for shares in the A.E.G., it was mentioned that ordinary shares in the former for £1,738,000, had been exchanged, out of a total ordinary share capital of £2,205,000. The accounts show the following figures for the past two years:—

	1913-14.	1914-15.
Ordinary share capital	£2,205,000	£2,205,000
Preference shares, 4½ per cent.	1,000,000	1,000,000
Loans	2,792,000	2,792,000
Gross profits	962,000	798,000
Interest on loans	119,000	119,000
Renewal fund	32,000	27,000
Depreciation fund	256,000	249,000
Net profits and balance forward	567,000	426,000
Dividend on ord. shares	264,000	198,000
Dividend on ord. shares, per cent.	12	9
Carried forward	13,000	17,000

The report states, further, that the value of the connections advanced by 19,788 KW. to 300,472 KW. during the year, the increase representing 80,402 glow lamps, 2,007 motors, and 586 apparatus, and at the end of June, 1915, the connections comprised 2,187,203 glow lamps, 41,472 arc lamps, 44,950 motors, and 8,453 apparatus. The number of customers advanced to 51,769, and the deliveries were 252,762,233 KW.-hours, as compared with 267,589,125 KW.-hours in 1913-14, the decrease being attributed to the influence of the war.

Reductions of Capital.

County of Durham Electrical Power Distribution Co., Ltd.—A petition to confirm a reduction of capital of the County of Durham Electrical Power Distribution Co., Ltd., of Newcastle-on-Tyne, came before Mr. Justice Sargant in the Chancery Division, on Tuesday. Mr. Martelli, K.C., for the company, said it was proposed to reduce the capital from £500,000 in 100,000 £5 shares to £300,000 in £1 shares. The reduction was to be effected by cancelling capital lost or unrepresented by available assets to the extent of £2 per share, and by sub-dividing each £3 share into three £1 shares. The loss of assets amounted to £207,000, and it was proposed to write off £200,000. There had been a depreciation of the company's investments, which were of the nominal value of £282,000. The chief reason for the loss of assets was a change in the method of generating and distributing power since the company was incorporated in 1899. At that time it was the practice to use a number of small power stations, but now it was considered better to use one large central station. The company had recognised this, and had entered into an arrangement with the Newcastle-on-Tyne Co., the effect of which was to render a large proportion of their stations commercially useless. No dividend on the ordinary shares had been paid since 1907. His lordship confirmed the reduction.

"Z" Electric Lamp Manufacturing Co., Ltd.—Mr. Justice Astbury, in the Chancery Division, on Tuesday, on the petition of this company, sanctioned a reduction of capital of the company from £150,000 to £15,000. Counsel stated that the loss of assets was chiefly on the value of the company's patents.

Petrograd Electric Lighting Co. of 1886.—At a meeting of the Zurich Bank for Electrical Undertakings, on November 3rd, it was mentioned that the danger of the Petrograd Electric Lighting Co. of 1886 being compulsorily liquidated by the Government had passed away, the company having been placed solely under State supervision. It was, however, unfortunate that the Moscow City Council was attempting to bring about the liquidation of the Petrograd company or its supply works in Moscow, so as to gain premature possession of the local works. The former Ministerial Council had adopted a negative attitude towards these endeavours, but a change in the Ministry had just taken place, so that it remained to be seen whether the liquidation would now be undertaken.

International Light and Power Co., Ltd.—The report for the year to June 30th, 1915, states that the net profit, after payment of interest on debentures and London and Canadian administration charges, is £10,273, plus £3,886 brought forward, making £14,160. The preference dividend at the rate of 6 per cent. per annum for the year has been paid, absorbing £12,328, leaving a balance of £1,831 to be carried forward. The progress of the subsidiary companies in Venezuela and the Argentine has been retarded by the effects of the war. The political and social upheaval in Mexico has greatly depreciated the national currency, and the earnings of the Mérida undertaking have been seriously affected thereby.

Southern Brazil Electric Co., Ltd.—The report for the year ended June 30th states that the net earnings of the several Brazilian undertakings, so far as at present ascertained, show as a whole an increase in currency of about 8 per cent. on the year. On the other hand, the heavy depreciation of the Brazilian exchange tells severely upon the sterling revenue figures. After deduction of all charges in Brazil and London and of interest on debentures to July 1st, 1915, there remains a balance to the credit of profit and loss of £2,127, which the directors propose to carry forward.—*Times.*

Castner-Kellner Alkali Co., Ltd.—The directors have declared a final dividend at the rate of 24 per cent. per annum for the six months ended September 30th, 1915.

STOCKS AND SHARES.

Tuesday Evening.

The principal market in the Stock Exchange this week has been that for rubber shares. The rise in the price of the commodity, and the really excellent reports which are being made by many of the younger, as well as the senior, companies have attracted public fancy, with the result that the market during the past few days has worn an appearance strongly reminiscent of the boom time of 1909-1910. A thin film of dust, for instance, hung over the market. The press and crush were so great all day that perspiration streamed from the faces of those engaged in the business.

Money has not been made in the same way as it was in those days, for the simple reason that, speculation being prohibited, as well as open bidding and offering, there is an end to the dealing in such large lines of shares as enabled the big turns to be made in times gone by. When there are a lot of transactions in 50 shares at 2s., with commission at a halfpenny per share, the volume of work will be enormous, but the remuneration scarcely so marked.

In other departments, the uncertainty surrounding the attitude of Greece, to say nothing of that of Roumania, has provoked a little selling here and there. News from the Near East is too obscure to encourage Stock Exchange business, and investment buying has died away to some extent, although, taking the Stock Exchange round, there is a good deal more going on than might have been supposed when one remembers that the country is at war, and a good part of Europe engaged on the same sanguinary work.

Brazilian issues of various kinds are again on the mend. The recovery cannot be in connection with the rate of exchange between London and Rio, because this has remained about 12⅜d. for a week or more. But every day brings along new buyers for Brazilian securities; and in the inquiry for Government and municipal bonds, the tramway and other utility securities are not overlooked. Rio Tramway Firsts are firm at 93¼, and the Seconds at 83. Anglo-Argentine Tramway issues, too, are in further request, and sharp rises have occurred more particularly in the first preference shares and in the 5 per cent. debenture stock. Other Argentine securities are more popular than they were, though some doubt exists as to the various harvests of the Republic, a good deal of news received in connection with the crops being conflicting, where it is not actually contradictory.

Mexican descriptions keep steady, but, in consequence of the lack of information with reference to affairs in the country, the recent buyers have stayed their hands, although very little stock has come into the market. The disposition is to

wait for more definite news before either buyer or seller will make a move. New York is so absorbed in piling up profits, directly or indirectly through the war, that the rumour factories are not troubling to manufacture Mexican news at the present time. Doubtless, however, this will come in due course. Meanwhile, the only change in the group is a good rise in Mexico Tramways to 40, Mexican Light & Power common keeping steady at 10 points lower.

The theatrical movement of the week is a jump of 15 points in City Services common shares, and nearly as much in the preferred; this has lifted the prices to 94 and 83 respectively. No dividend has been paid on the preferred since July, 1914, but the company has just published a scheme whereby fresh capital will be assured and the company placed in a position to earn dividends on its common shares. The pyrotechnical rise was brought about, of course, purely by New York buying, and it gave people on this side an opportunity of selling their shares, of which some, at any rate, of the holders did not fail to take advantage.

Consolidated Gas & Electric Power of Baltimore common and preferred have reacted a trifle after their recent display of strength, and the American-Canadian munition shares of various kinds are mostly a little lower. It is stated, nevertheless, that both Canada and the United States are receiving huge orders for munitions from Great Britain and from Russia, both of whom, by the way, are also credited with being very large buyers of war material in Japan.

Electric lighting shares are so quiet that not a single alteration has taken place in the list of prices. It is a long time since this has happened, although it was a state of affairs common enough week by week a year ago. Manufacturing issues are almost equally quiet. Castner-Kellners are better at 3¼, on the dividend announcement, making 20 per cent. for the year, as against 15 per cent. in 1913-14. Callender's debenture stock came to market without finding any ready support, and the price has, consequently, been marked down 7 points to 85.

This is an illustration of the manner in which a good many investment securities will have to be scaled down when holders want to sell, because obviously there is not much attraction in a commercial debenture stock yielding 5 per cent., however excellently secured, if the British Government is paying 5¼ per cent. for money at three, six, and twelve months dates of repayment. Treasury Bills, from which this rate of interest is obtainable, are a form of security the return on which, certain holders claim, is not subject to income-tax; and we suppose that there are not wanting some people quite ready to take advantage of such elasticity of conscience as Treasury Bills invite, and who would not return this income—for such it actually is—on the usual form.

Home Railway stocks are not a bad market, on the whole, although some of the recent steam has evaporated. The feature is the strength of Underground Electric income bonds, which are 3½ points higher at 74½. The rise is due to buying on behalf of those who look at the high yield and the fact that the interest is paid free of tax. The Company's first income debenture stock, which is cumulative, stands at 104. There is no particular change in either class of the shares.

New York Telephone bonds are good at 101¼, recovering the greater part of the interest payment recently deducted. Western Telegraphs have also picked up the dividend taken off the price last week. The Eastern group is firm, with small improvements in Eastern Extensions and Eastern Telegraph ordinary stock. Globe Telegraph & Trust shares of both classes retain their rise, and there is a little investment business going on in them. Marconis are also somewhat harder, but Americans keep quiescent at 17s. 9d. Substantial improvement has occurred in many of the shares in the copper mining list; indeed, the markets for nearly all base-metal shares are substantially stronger than they were a week ago.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Blackpool-Fleetw'd	Sept. 25	7,035	+ 2,182	38	33,886	— 458	8	..
Bristol	Oct. 29	86,771	+ 4,766	43	412,573	- 38,565	80·5	..
Cork	„ 28	1,946	+ 101	43	21,830	- 28	54·25	..
Dublin	„ 29	24,221	1,518	43	261,876	- 10,457	9·89	..
Hastings	„ 24	3,551	6	..	..	- 58	19·8	..
Lancashire United	„ 27	6,774	715	4	75,561	+ 4,642	42	..
Llandudno-Col. Bay	„ 29	1,043	- 279	42	16,583	+ 1,637	6·5	..
Tyneside	„ 27	2,293	— 204	17	10,950	— 503	11	..
Anglo-Argentine ..	„ 28	204,274	- 746	3	2,193,260	—138,485	..	..
Auckland	„ 22	20,831	- 1,054	16.2	83,126	— 2,001	25·42	1·06
Calcutta	„ 30	17,119	- 2,493	..	..	+ 3,935	..	..
Kalgoorlie, W.A. ..	August	3,16	..	35	22,119	..	..	..
Madras	Sept. 15	2,05	- 239	37	34,819	+ 458	..	..
Montevideo ..	October	27,157	+ 667	52	330,683	—30,882	..	..
Dublin-Lucan Rly.	Oct. 29	796	+ 78	17	2,719	+ 98	7	..

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price Nov. 16, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	7½	—	£6 18 4
— do. 7 per cent. Pref.	7	7	—	5 0 0
Charing Cross Ordinary	5	8⅝	—	7 2 10
do. do. do. 4½ Pref.	4½	8¾	—	6 0 0
do. do. City Pref.	4½	8⅝	—	6 8 7
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4½	—	5 17 8
do. 4½ Deb.	4½	87	—	5 3 6
City of London	9	12½	—	7 7 3
do. do. 6 per cent. Pref.	6	10¾	—	5 11 4
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10	—	7 0 0
do. do. 6 per cent. Pref.	6	10½	—	5 17 3
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	88 xd	—	5 8 0
Kensington Ordinary	9	6	—	7 10 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref.	6	4½	—	7 1 2
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	8½	2½	—	7 15 7
do. 4½ per cent. Pref.	4½	8¾	—	6 0 0
do. 4½ Deb.	4½	85	—	5 6 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6½	—	7 13 10
do. do. do. 7 per cent. Pref.	7	6	—	5 16 8
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	1 1/16	—	6 14 0
Westminster Ordinary	9	6½	—	6 18 6
do. 4½ Pref.	4½	4⅜	—	5 9 0
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	10⅞	— ¼	5 18 0
do. Def.	1½	28	+ ½	6 10 5
Chile Telephone	8	6½	—	6 3 0
Cuba Sub. Ord.	5	8	—	6 5 0
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11⅞	+ ⅛	*6 15 0
do. 4 Deb.	4	80	—	5 0 0
Eastern Tel. Ord.	7	124	+1	*6 9 0
do. 8½ Pref.	8½	66	—	5 6 0
do. 4 Deb.	4	82	—	4 18 0
Globe Tel. and T. Ord.	6	10½	—	*6 13 9
do. Pref.	6	10½	—	5 17 1
Gt. Northern Tel.	22	83½	—	6 11 4
Indo-European	13	46 xd	—	6 18 4
Marconi	10	1⅜	+ 1/32	5 10 6
New York Tel. 4½	4½	101½	+1½	4 8 9
Oriental Telephone Ord.	10	11⅞	—	5 8 1
do. Pref.	6	8	—	6 17 2
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5⅝	—	*8 2 6
do. Pref.	6	4⅞	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	12⅝ xd	—	*6 9 4
do. 4 Deb.	4	80	—	5 0 0
Home Rails.				
Central London, Ord. Assented	4	68	—	5 16 0
Metropolitan	1½	24½	— ½	4 18 0
do. District	Nil	14½	—	Nil
Underground Electric Ordinary	Nil	1⅜	—	Nil
do. do. "A"	Nil	5/-	—	Nil
do. do. Income	6	74½	+3½	*9 8 0
Foreign Trams, &c.				
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
do 5 Deb.	5	97	—	5 3 0
Anglo-Arg. Trams, First Pref.	5½	4	+ ¼	6 17 6
do. 2nd Pref.	5¼	4⅜	+ ⅛	8 3 0
do. 4 Deb.	4	76	+ ½	5 5 3
do. 4½ Deb.	4½	75	—	6 5 0
do. 5 Deb.	5	80	+¼	6 11 7
Brazil Tractions	2½	57½ xd	—	6 1 9
Bombay Electric Pref.	6	10½	—	5 17 1
do. 4½ Deb.	4½	87	—	5 3 0
Mexico Trams	Nil	40	+6	Nil
do. 5 per cent. Bonds	—	50	—	Nil
do. 6 per cent. Bonds	—	44	—	Nil
Mexican Light Common	Nil	30	—	Nil
do. Pref.	Nil	40	—	Nil
do. 1st Bonds	—	70	—	—
Manufacturing Companies.				
Babcock & Wilcox	14	2 1/16	+ 1/16	6 1 9
British Aluminium Ord.	5	1⅛	—	4 14 1
do. Pref.	6	18/3	—	6 9 9
British Insulated Ord.	15	10⅜	—	7 8 2
do. Pref.	6	5½	—	5 2 2
British Westinghouse Pref.	7½	84/-	—	8 10 8
do. 4 Deb.	4	72	—	5 11 1
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	10½	—	7 2 10
do. 5 Pref.	5	4½	—	5 11 8
do. 4½ Deb.	4½	85	- 7	5 6 0
Castner-Kellner	20	63½	+1/3	6 8 0
Edison & Swan, £8 pd.	Nil	10/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	57	—	7 0 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/-	—	9 4 8
do. do. Pref.	7	19/9	—	7 1 4
Gen. Elec. Pref.	6	9½	—	6 6 4
Henley	20	12½	—	*8 19 4
do. 4½ Pref.	4½	4½	—	5 0 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	7⅞	—	6 5 0
Telegraph Con.	20	83½	—	*8 3 0

* Allowance made for dividends being paid free of income-tax.

Fire at American Works.—Reuter reports that damage to the extent of £200,000 has been done by fire, the origin of which is uncertain, at the mills of John A. Roeblings, Sons and Co., at Trenton, New Jersey, who are manufacturing barbed wire for the Allies.

SHANGHAI ELECTRICITY WORKS.

(*Concluded from page* 627.)

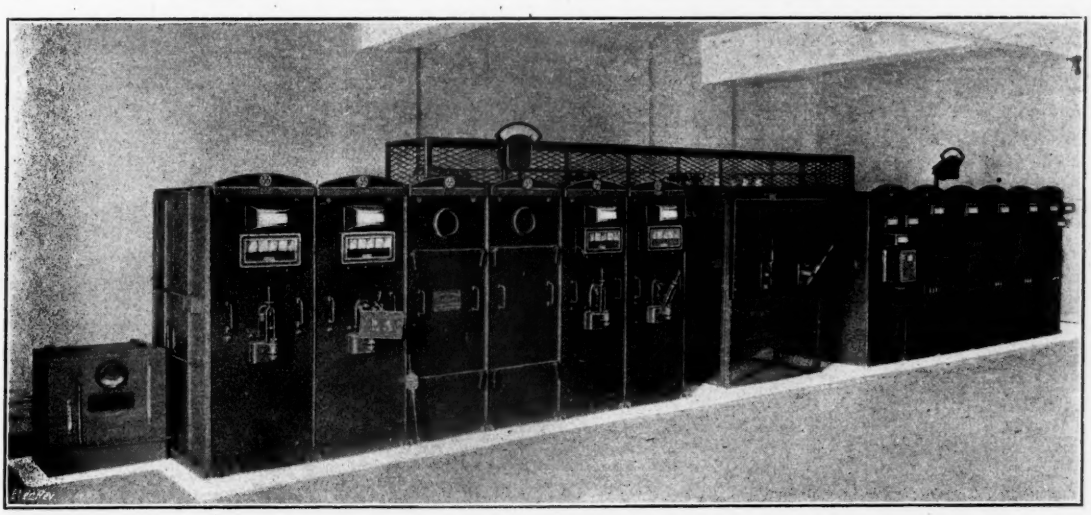
As we have already indicated (June 25th), although the Riverside station has hardly yet been completed, the rapid increase in the demand has compelled the supply authority to undertake large extensions, and Mr. Aldridge recently paid a visit to this country in connection with a scheme for the installation of additional plant of 20,000 KW. capacity, together with the necessary steel buildings to form an extension of the Riverside power house, and additional switchgear and cables. The extension will bring up the capacity of the station to 34,000 KW. At Fearon Road station two 600-KW. A.C. generating sets will be removed to make room for extra-high-pressure switchgear; this station will then have a capacity of 3,200 KW. (in addition to the traction plant), making the total capacity of the Shanghai municipal plant about 37,200 KW. The new extensions will be carried out on such lines that the old Fearon Road station, which is geographically the centre of Shanghai, will become a large distributing station, and eventually this will be fed by trunk feeders at 20,000 volts from Riverside.

Mr. Aldridge informs us that both lighting and heating are making steady progress, but the power demand shows a phenomenal increase; several large cotton mills are now connected to the mains, taking a bulk supply, one mill alone takes over 1,500 KW. day and night—most of the Shanghai mills work 24 hours a day. At the end of last year a new flour mill, equipped with the most modern American flour-milling machinery, was started up with power from the Council's mains, taking about 600 H.P. Other mills are being converted, and new ones erected—one which will be erected in the near future, adjoining the Riverside power house, is likely to require at least 2,000 KW. Whereas last year the units sold totalled 32,885,000, they are expected this year to reach 56,000,000, divided up as follows:—Private lighting, 16,980,000; power, 33,612,000; heating, 554,000; public lighting, 1,000,000; traction, 4,000,000.

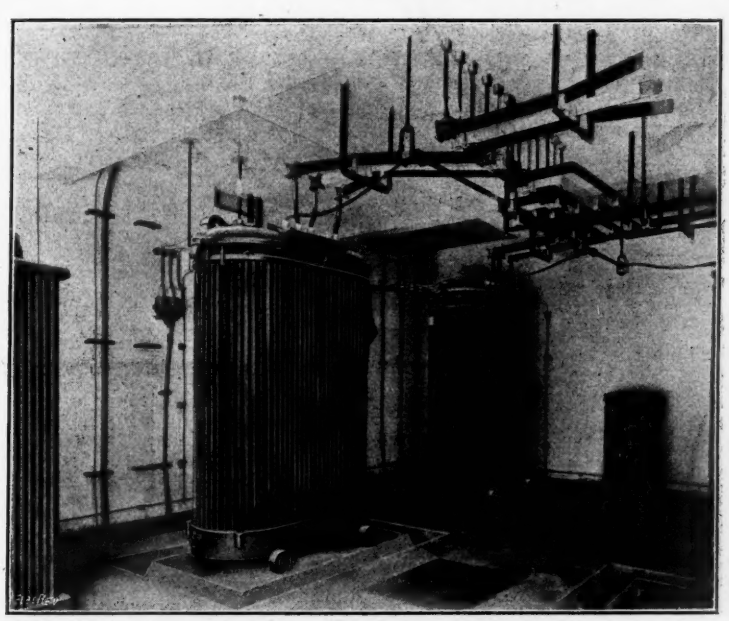
Since the introduction of metallic-filament lamps in 1910, the yearly rate of progress in the demand for private lighting has been as follows:—1911, 767 KW.; 1912, 1,993 KW.; 1913, 2,100 KW.; 1914, 3,500 KW.; 1915 (estimated), 4,600 KW.; 1916 (estimated), 5,000 KW.

The maximum load in 1916 is expected to be 21,000 KW., of which about 1,000 KW. is required for traction, leaving a load of 20,000 KW., to meet which there is a total installed plant capacity of only 18,400 KW., without reserve. Thus it will be seen that the necessity for extension is imperative. The present "extension," in point of fact, is half as large again as the first section of the Riverside station.

The new plant and the existing Riverside station will operate in effect as two independent stations, with separate boiler house plant and switchgear, although they will feed into a common distributing system. All the generators will work at 6,600 volts, transmitting direct to Fearon Road only, a distance of five miles; but whereas at present the trunk feeders are operated at this pressure, in the case of the new plant each generator will be coupled directly to step-up transformers raising the pressure to 22,000 volts, at which pressure the new bus-bars will be fed through oil switches. This section of bus-bars will be electrically coupled to the existing 6,600-volt bus-bars through transformers.



BRITISH THOMSON-HOUSTON 6,600-VOLT SWITCHGEAR IN STANDARD 2,000-KW. SUB-STATION.

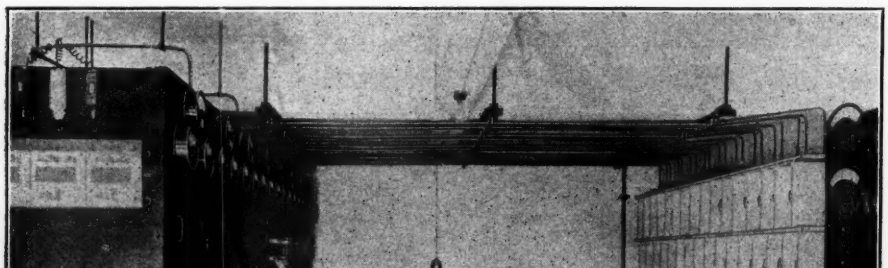


THREE-PHASE 625-K.V.A. TRANSFORMERS IN SUB-STATION.

The feeders will be taken off the extra-high-pressure bars through oil switches, and will deliver through step-down transformers to the 6,600-volt bus-bars at Fearon Road station, these bus-bars being coupled to the existing bus-bars through reactance coils. From Fearon Road duplicate

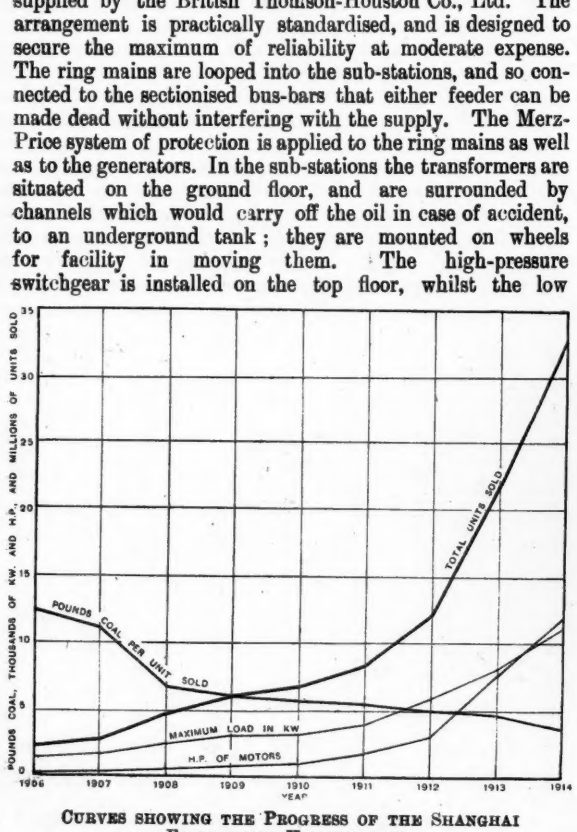
ring mains connect up the principal sub-stations in the city. In addition, an outer ring supplies the more distant sub-stations; this outer ring is also supplied by a pair of mains taken diagonally across to a point five miles from Fearon Road—that is, 10 miles from Riverside. It is proposed later on to increase the pressure on the diagonal mains to 20,000 volts by the use of step-up and step-down transformers. The total cost of the extensions is estimated at about £240,000.

We give herewith some illustrations of the equipment



B.T.H. Low-pressure Switchgear in Standard 2,000-kw. Sub-station.

of the sub-stations, with high and low-pressure switchgear supplied by the British Thomson-Houston Co., Ltd. The arrangement is practically standardised, and is designed to secure the maximum of reliability at moderate expense. The ring mains are looped into the sub-stations, and so connected to the sectionised bus-bars that either feeder can be made dead without interfering with the supply. The Merz-Price system of protection is applied to the ring mains as well as to the generators. In the sub-stations the transformers are situated on the ground floor, and are surrounded by channels which would carry off the oil in case of accident, to an underground tank; they are mounted on wheels for facility in moving them. The high-pressure switchgear is installed on the top floor, whilst the low



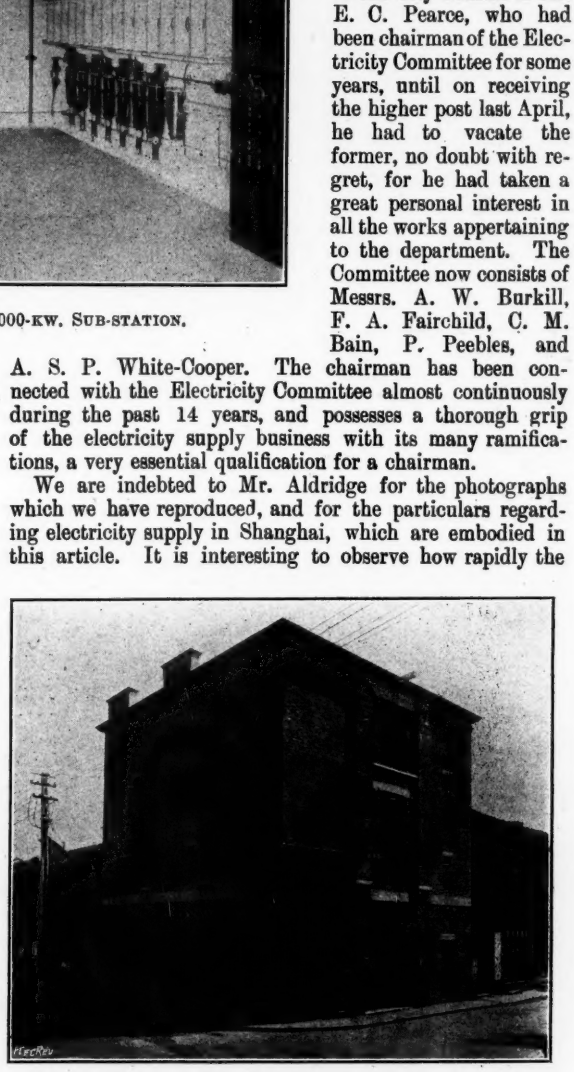
Curves showing the Progress of the Shanghai Electricity Undertaking.

pressure gear is on the middle floor, to reduce the length of heavy cables leaving the station. The high-pressure switches are of the B.T.H. "truck" type, which can easily be withdrawn from their cubicles for cleaning or repair. It will be noticed that hardly any cables leave the sub-stations overhead—only the street lighting cables; the main distributors are usually laid underground from the sub-station for a sufficient distance to avoid the appearance of congestion overhead; they are then taken up the channels of I-section reinforced concrete terminal poles to connect with the overhead cables, armoured cables and Siemens pot-heads being employed.

The whole of the plans and specifications for the works have been prepared by Mr. Aldridge, as municipal electrical engineer; in the case of the extensions, Mr. Aldridge works in conjunction with Messrs. Preece, Cardew, Snell and Rider. In our issues of April 21st and 28th, 1911, we reproduced at considerable length their reports on the first instalment of plant and mains in connection with the Riverside station.

The present chairman of the City Council is Mr. E. C. Pearce, who had been chairman of the Electricity Committee for some years, until on receiving the higher post last April, he had to vacate the former, no doubt with regret, for he had taken a great personal interest in all the works appertaining to the department. The Committee now consists of Messrs. A. W. Burkill, F. A. Fairchild, C. M. Bain, P. Peebles, and A. S. P. White-Cooper. The chairman has been connected with the Electricity Committee almost continuously during the past 14 years, and possesses a thorough grip of the electricity supply business with its many ramifications, a very essential qualification for a chairman.

We are indebted to Mr. Aldridge for the photographs which we have reproduced, and for the particulars regarding electricity supply in Shanghai, which are embodied in this article. It is interesting to observe how rapidly the



Exterior of Standard 2,000-kw. Sub-station, Shanghai Municipal Electricity Supply.

advantages of electricity for lighting, heating and motive power have made themselves felt in this great Eastern town, and gratifying to know that the undertaking is in the capable hands of an English engineer, who is wisely given a pretty free hand by his Committee, and is supported by a very able staff of British colleagues.

Mr. Aldridge, after a somewhat strenuous sojourn in this country for a few weeks, left again for Shanghai at the end of last month, with our best wishes for the continued prosperity of his big undertaking.

GERMAN BUSINESS METHODS AS I KNEW THEM.*

Except that a working journalist is supposed to possess a good many of the attributes of a dynamo, I am at a loss to comprehend why I have been honoured with an invitation to address the British Electrical and Allied Manufacturers' Association.

A journalist always skates on thin ice when he attempts to talk business with business men. There are only three or four of us who know anything about business, and the rest of us are all working for them.

During my ten years' of professional activity in Berlin as the resident correspondent of London and New York newspapers, my time and thought were largely preoccupied with observing and reporting the Fatherland's preparations for her assault on a peaceful and happy world. My lot was cast in Germany in the years when the tiger was crouching for the attack. He—let that at least be said to his credit—made ready for the fray without stealth. He sharpened his teeth for all the world to see and hear.

Foreign correspondents in Berlin, even though bound to specialise in high politics, could not live there as long as I did without acquiring at least a knowledge of German business methods in broad outline. As I look back upon them now, I envisage them as a strange combination of scientific efficiency and diabolical unreliability. When I heard the German Chancellor, on August 4th, 1914, confess to all the world from his high place in Parliament that Germany had violated Belgian neutrality because "necessity knows no law," I heard him give expression to the basic principle of German business methods. Germany's conduct in war is on all fours with her practices in trade. In both, she believes that the end justifies the means. Never in all my long residence in Germany could I reconcile the skill, enterprise, and industry of the average German business man with his incredible disregard for the elementary principles of honour, propriety, and generosity. It is a hideous everyday commercial axiom in Germany that a man does not live up to his word of honour in business because he is not expected to. I once told a Berliner that a German always keeps his word, because he cannot get anybody to take it. That was too subtle for the Hun, and he is probably wondering yet what I meant.

The German business man is certainly an incongruous mixture of sagacity, zeal, and cunning. You go to Germany to give an order, let us say, for an electrical installation. The company with which you are about to deal will have you fetched at the station in a luxurious motor-car and send to welcome you a director who can talk English as well as you can. You will be escorted to a *de luxe* hotel, where delightful apartments have been reserved for you, and you will probably be confronted before the dust of travel has been removed with an elaborate schedule of how it is proposed to occupy your time outside of the hours when you are not at the works. For the week of your sojourn you will be blown off to entertainment and honours a potentate might envy, and you will leave town thinking, quite rightly, that as a business diplomat the German who has wined and dined you, and been your Diogenes through the highways and byways of his stupid "night life," is without a peer. But you will not have gone half-a-day's journey toward home before your late opulent host will begin to plot to get the best of you under the contract whose ink is not yet dry. He will keep the contract if it is in his manifest interest to do so. He will break it if he has a ghost of a chance to do so without any greater peril than a law-suit. If he is fighting a foreigner in his German courts, a law-suit can hardly be properly described as a peril, for in the compiled judgments of German courts cases are few and far between in which contract law has been interpreted to the disadvantage of a native litigant.

In the lexicon of German commerce there is no such word as "faith." Probably that is so because in the German language there is no such word as "gentleman." The unreliability of a promise is common in the most trifling departments of business in Germany.

The German business man is not constituted to view with equanimity a deal which has not turned out as profitably as he had hoped. Then it is that he will not shrink from squirming out of his contractual obligations either deliberately and in cold blood or seeking the sanction of the law for doing so. He has been known, for example, to do something like this: He will give A, let us say, exclusive agency rights in England for a German speciality for a fixed period of years. Aggressive, ambitious, and eagerness personified, he finds at the end of six months that A's sales are not up to the German's expectations. Thereupon he will not have the slightest compunction in entering into a surreptitious bargain with B for competitive rights with A, assuring B convincingly that he is in no way infringing A's rights. If there is trouble, he lets A and B fight it out. Take this case: A foreign corporation owns a trade-mark for a food product of international reputation; let us call it, for the purposes of the story, Congealed Prunes. The firm is surprised one fine day to learn from a friendly source in Hamburg that the Congealed Prunes Co., Ltd., of Berlin, is doing a massive trade in that well-known and popular brand of merchandise. The foreign concern finds that passing strange, as it has never exported to Germany. It sets inquiries afoot. What does it find? That a couple of estimable gentlemen, named Schultz and Meyer, having ascertained that Congealed Prunes were a good thing, in more ways than one, decided to annex the trade-mark for Germany and Austria, and having duly registered it at the Imperial Patent Office, were now its inviolable possessors under German law. They might have acquired Pears's Soap, or Beecham's Pills, or Westinghouse Air-brakes in the same way and proceeded to manufacture under those names a German substitute for the real article.

There is an immense traffic in illicit business information in Germany. Priceless commercial secrets have a habit of reaching competitors with frequency. Again, I presume that misdemeanours of this sort are not unknown in this country; but I am convinced that underground trading in the private affairs of your rivals, who are often your friends, goes on in the German business world to an extent utterly unknown in Anglo-Saxon communities. Sometimes I have thought that it is the eagerness of German banks to exploit new industries that has encouraged the practice of an engineer or a department superintendent or a managing director going to a bank and inducing it to finance a competitive works purely on the assurance that the applicant for capital, through his confidential knowledge, is able to snatch the business of an older-established concern in whose employ he has been for many years, and often enough still is. It is considered perfectly ethical from a German banker's standpoint to supply funds for industries born under these criminal auspices. I have been told that many successful German works came into existence in exactly that way. Everybody does it, so custom seals it with approval. It is just as recognised a business proposition, I suppose, as it is for a German cavalier to advertise in a newspaper that "a man of good appearance, excellent family, university training, and congenial nature, is willing to marry into a well-established business—only child preferred." For years you in this country have extended limitless hospitality to young Germans, who have made you believe that they were willing to work long hours in your offices and works for the purpose of acquiring the English language and British business habits. I wonder if it has ever occurred to you that they might also have been possessing themselves of your vital business secrets and communicating them, in the magnificent spirit of "Deutschland uber Alles," to some unknown General Staff of Commerce and Trade in Berlin or Hamburg, there to be filed, card-indexed, and exploited in Germany's boundless purposes in the markets of the world. I do not allege that the German "volunteers" who have thronged the City and the shipping offices and counting houses of Liverpool, Manchester, Birmingham, Bradford, Glasgow, or Sheffield for the past twenty years have actually been commercial spies, but I do say that, judging by conditions in their own country, they were not above it. I am afraid that the cheap German clerk who has infested British offices was one of the costliest investments British business men have ever made.

I pass now, though I have only tried to sketch the one side of the medal in vaguest outline, to the other and brighter side. There *is* another side, and it *is* very bright. I refer to the splendid groundwork of organisation on which the German commercial structure rests. To you men of the British Electrical and Allied Manufacturers' Association any account of German industrial organisation must be an old story. I should think it were a tiresome story, too, in many respects, for the world, in its admiration of scientific business management in Germany has been a little prone to exaggerate its merits. I would consider it impertinent for me to attempt to tell you either of the existence or excellence of German organisation in your own branch. I am sure that the broad, general scheme under which the A.E.G. and the Siemens-Schuckert concerns wage trade war at home and abroad are perfectly well known to you, and that nothing I could say to you about them could conceivably sound anything but amateurish, and would probably be brilliantly inaccurate.

I am fairly certain that a trip through your great works at Trafford Park, Rugby, Stafford, Wolverhampton, Birmingham, or Bradford would reveal to the practised eye that shop management in the British electrical trade is in every respect on a par with any systems which have sprung from the brain of a Rathenau. I have heard it said that perhaps in only one department of your industry has German practice given better results than those achieved in this country. I allude to the passion of the German manufacturer for specialisation. To this is due his habit of employing an extraordinarily large number of engineers. An American engineer once told me that in a works employing 500 men it was not uncommon in Germany to find a staff of 50 engineers. These engineers, on their part, are content to devote their skill and energies indefinitely to a specific and more or less minor speciality and to concentrate on developing it, instead of aspiring to generalise in the engineering field, even though thereby the status and emolument of the engineer might be considerably improved. The result of this system, as far as the works is concerned, is that it marshals an engineering staff of varied and highly specialised talents, their joint teamwork insuring the maximum of general efficiency. In practice

* Abstract of some remarks by Frederic William Wile, late Berlin correspondent of the London *Daily Mail*, at an informal gathering convened by the British Electrical and Allied Manufacturers' Association.

this system also, I suppose, results in a works obtaining valuable markets for specialities. It is all part and parcel, this specialising mania of the Germans, of their infinite capacity for taking pains: a trait which has as much to do with their conquests in the foreign trade realm as any other one factor. The readiness of the Germans to make anything for anybody anywhere is one of the secrets of his international commercial progress.

The German has always looked up to Great Britain as the master business mind and the Mecca of all those who would study commerce at the fountain head. That is why the three greatest commercial geniuses Germany has produced in our time—Ballin, the shipping king; Thyssen, the Carnegie of the Fatherland, and the elder Rathenau, who died in June—all served their business apprenticeship in these islands. No modern young German business man, at least before the *Gott strafe England* era, considered that he had had a proper start in life without personal acquaintance with the commercial practices of this country. He may have had his degree from the Commercial High School or the Colonial Institute of Hamburg or Cologne, or graduated from the great Charlottenburg Technical College at Berlin, but until he had actually taken a course with the "Shopkeeper of the World," he looked upon his training as incomplete. It is probably known to most of this audience that the Allgemeine Electricitäts Gesellschaft, of Berlin, when it decided, about ten years ago, to go in for export trade on a broad scale, entrusted the organisation and management of that department to an English engineer. When he took charge, the A.E.G. were doing £100,000 a year in export. When he left their service at the outbreak of the war they were doing £2,000,000. When Lord Claude Hamilton, the chairman of the Great Eastern Railway, a few years ago set up the remarkable doctrine that England had no young men of sufficient managerial capacity to run a great transportation system, I recalled how Germany had found it necessary to come to England for a 31-year-old engineer to superintend the foreign trade of her greatest electrical undertaking.

Yet, even though Germany has traditionally looked upon Britain as the mother of commerce and trade, the Germans have undoubtedly outstripped this country in respect of organisation. Still an agricultural State long after England was a great industrial State, it was necessary for Germany to resort to intensive methods if she was to catch up with a country decades ahead of her in wealth, power, plant, and experience. Against the superior numerical strength and natural resources of Britain she decided to match organisation. It is the same card on which she staked her chances to win this war. She knew perfectly well that in all the potential sinews of war—men, money, munitions, food, ships, and everything else—she was palpably inferior to the combined resources of the Allies, and that her inferiority must become more marked the longer war lasted. What she figured on was that German super-organisation of inferior resources would overcome unorganised superior resources.

Without straying farther from the point, let me repeat that Germany resorted to hyper-organisation as the most effective means at her command to overtake the lead of older industrial civilisations. Dr. Walther Rathenau once explained to me that that is the reason why the Fatherland in the past 44 years has developed numerous business geniuses, but no great politicians. When Bismarck built the Empire with the cement of blood and iron, he fashioned a structure so complete for all immediate purposes that the brains of the country, eschewing politics as a useless career, went in for business as the field which offered the greatest promise of both fame and fortune, as well as the greatest opportunity for national service.

How zealously and successfully they went to work Germany's trade balance in the last year before war is eloquent testimony. To me it will for ever remain testimony that, however much the German war party, who caused the war, hankered for it, the German business world wanted peace. Germany's industrial development is a romance well worth a historian's narration, and, once written, will deserve a place among the text-books of all peoples desirous of raising themselves to economic affluence. It will tell of almost countless guilds, leagues, associations, and societies, and notably the powerful Cartels, or syndicates for regulation of sales, prices, and output, formed to deal with every branch and sub-branch of mercantile activity. Cartels are the German name for trusts, which they resemble in all essentials. I recently heard the statement made that there are no less than 30,000 associations of one sort or another dealing with the question of foreign trade alone; a likely enough assertion when we stop to consider that German economists acknowledge that 72 per cent. of the population is directly dependent upon industry, as compared with 28 per cent. which lives on agriculture.

But it is to the tremendous zeal and application of the German, especially in export trade, that his success is principally due. He is an insatiable student of the demands of the particular market on which he has designs. He puts its local customs, prejudices and traditions under his microscope before he begins catering for its business. He learns, in particular, all there is to know about its credit system, and prepares to accommodate himself to it. He will not be ashamed, if necessary, to wait three or five years for his money, where an Englishman, a Frenchman, or an American would not dream of extending credit for more than 90 or 100 days. I have been assured by a notable member of your own trade that no German merchant ever took an order away from an English, American, or French firm *on equal terms*. Either the German goods were lower in price, or they were a good deal better for the same price, or there was some distinct advantage of some other kind. The German makes it his business, somehow, to see that the advantage is there. It may only take the form of submitting catalogues or tenders to the firm in Holland in the Dutch language and in guldens, or to the prospective customer in Spain in Spanish and pesetas, or the German may be guilty of so revolutionary a thing as to cut his cloth for Patagonia as the Patagonians want it, and not as the Germans think they ought to have it.

Then, there is the systematic and sleepless support which the German Government affords to its business pioneers throughout the world. German Embassies and Legations, besides being centres for purely diplomatic intriguing, are headquarters of the German business organisation in their particular capitals and countries. A German business man never appeals to them in vain for counsel or assistance. The German consular service throughout the world is a business-getting service, pure and simple. But in addition to all these external aids to trade there is the wise system of developing commerce by sagacious legislation at home. I mean, of course, most particularly, the scientific protective tariff, with its "fighting" rates, and the effective scheme of reciprocal commercial treaties which are based upon it. There is the intimate partnership between the great shipping companies and the Government, which finds expression in subsidies and liberal facilities for port and docking necessities. There is the practice of preferential rates to German merchants and manufacturers engaged in the export trade, for transport of both their raw materials and finished products over the lines of the State railways, or on the State-owned canals. There is that abiding interest in the welfare of industry which the Emperor never fails to take—such little things as going to the works of the A.E.G., as he did on one occasion which I well remember, to listen to a two-hour highly technical dissertation on a new turbine. There is the system which he insisted upon developing, much to the disgust of his snobbish aristocratic *entourage*, of conferring distinguished honours, social and otherwise, upon men whose claim to distinction was only that of having brought some new glory to German industry.

We read much these days of the "Capture of German trade," but I wonder if it is being approached with that far-sighted and comprehensive thought and energy which alone will pave the way to the desired goal.

I had an opportunity the other day of talking to an Englishman who knows more about German trade practices, especially in the realm of export, than any man now in this country. I asked him what he would do if Mr. Asquith decided to create a new Government department called "Office for War on German Trade" and placed him in autocratic charge. His reply was evasive, yet illuminating as a searchlight. He said: "England wouldn't know what to do with Germany's trade if it were offered to her on a silver platter to-morrow." England had not the necessary plant to begin with. That was obvious. Nor the available capital required for such vast extension of plant as coping with Germany's trade would demand. But what was a thousand times more deplorable was the deep-rootedness in the most eminent British industrial quarters of ethics and methods—at even the zenith of the Lloyd George "speeding-up" era—as violently out of tune with the needs of the hour as Nelson's wooden *Victory* would be among Admiral Jellicoe's ironclads.

In my German papers I read that German exporters are on tip-toe waiting for peace suddenly to break out, in order that the markets of the world may be the scene of dumping of vast quantities of Teuton wares on a scale hitherto unwitnessed. From a meeting of the leading German industrial associations at Dresden the other day a telegram was sent to the Kaiser assuring him that the manufacturers of the country, with their organisation, plant, energy, ingenuity, and eagerness unimpaired by the war, were only waiting for the moment to arrive when the German commercial army could once again clear for action throughout the globe. This is one of the most significant warnings from business Germany to reach the outer universe, and it ought to be taken seriously to heart in England. In the United States defensive measures are already in prospect. Congress is to be asked at its forthcoming session to pass legislation making it unlawful for foreign manufacturers to sell their products in America at less than the cost of production there, in order to protect American merchants from an inflow of cheap products from abroad at the end of the war.

I am aware that British industry in general, and your own great branch in particular, have concentrated during the past year on war and Government work. I know that this has seriously interfered with the prosecution of export trade, but unless you begin now, no matter how urgent your present pre-occupations, to look far ahead and think of things after the war, I am very much mistaken if you will not find that the Germans have out-generalled you. They, too, are pre-occupied with war work, and Jellicoe effectually frustrates, even if they were not, any possibility of their doing export business. But you may be quite sure that with their marvellous faculty for leaving no contingency uncontemplated,

they are at this very hour busily planning and plotting for a new raid on the world's markets of even a more determined character than any effort they have ever put forth in the past. With the vast accumulation of bonded indebtedness which your war finance is piling up, the need for intensive exploitation of export trade will be far more urgent than at any previous time in British history. Face the future now instead of later. Set Germany the pace, instead of following supinely in the lead she will be all too ready to assume. She relies on your "week-end habit of mind." She figures on exactly what is taking place: your absorption in the present, and characteristic British thoughtlessness for the time to come. Your fleet has paralysed German commerce during the war. Let British sagacity, thoroughness, far-sightedness, and organisation keep it paralysed after the war. "Waiting to see" will be as fatal to British industry as it has proved for certain politicians.

Above all, make your Government understand that you cannot meet German competition on equal terms, to say nothing of capturing German trade, until there is that offensive and defensive alliance between Government and industry which has contributed so largely to the development of the enemy's commerce both at home and abroad. Make your Government realise that one of their vital functions is to facilitate, not hamper, business. Make them see that the British business man is henceforth welcome at British Embassies, Legations, and Consulates in foreign parts, and no longer regarded an ignoble intruder on diplomats who spend far too much time merely in dining out on their country's behalf. Make your Government see what tariffs have done for German trade. Make them establish a ministry for foreign commerce with a minister at its head who is an eminent and practical business man, and not a meritorious politician.

Make your banks above all realise the *rôle* they have to play in promoting British export trade. Tell them how the story of German industrial development is very largely the story of lavish support of commercial undertakings by banking capital. Insist upon a condition in future where a manufacturer looking for funds for the foundations of a legitimate enterprise will be the most welcome of all visitors to the marbled premises of your joint stock octopuses. When the bankers of England have learned how the German merchant and manufacturer seeking trade abroad are accompanied step by step by the German banker, English financiers will have acquainted themselves with still another secret of German economic progress. And their studies will not be complete until they have looked into the system which German banks have brought to the point of a fine art, of extending the German credit scheme into whatever foreign district, no matter how remote, that Germans have invaded for trade purposes.

Make your great shipping and railway companies realise that, along with the banks, they are the natural allies of British business men in pursuit of foreign markets. Make them see that the extraordinary emergency in which the export trade will find itself at the close of the war requires extraordinary co-operation of all interested agencies, and that a spirit of broad-gauge and liberal concessions is required if the emergency is to be adequately met.

Make your rising generation of young business people appreciate the value of foreign languages. Not a few of the German triumphs in export markets, particularly in Britain's own Dominions and in the East, have been directly attributable to their command of English. Their progress is South America has been due in no little degree to the fact that they send there, with samples and order books, agents who know Spanish. Until you British equip yourselves to deal with the Russians in Russian, with the Scandinavians in their tongues, with all the purchasing peoples of the earth, in fact, in terms familiar to them, you will enter the forthcoming race for world-trade domination handicapped in favour of the painstaking, thorough-going German.

There are two or three other things in your power after the war which no amount of German organisation or recuperative talent can overcome, and you will be recreant, in my humble judgment, to your elementary self-interest if you fail to come to grips with them promptly and comprehensively. I would build round the British Empire first of all a tariff wall so high that no German manufacturer who ever lived could leap it. As eternal punishment for the crimes of which the *Lusitania* will for ever be the symbol, I would place the brand of Cain upon the forehead of German shipping by decreeing that a German vessel of commerce should never again pollute the waters of a British port. I would cause it to be looked upon as a disgrace for any British merchant to offer German goods across his counter. I would withhold the right of naturalisation from German subjects, for unless that were done the privilege of British citizenship might some day be extended to one of the executioners of Edith Cavell or a man who helped to murder our wives and children from the bomb platform of a Zeppelin. I know that time heals even the scars of a great war, but the wounds which German warfare has ruthlessly cut across not only the British Empire, but civilisation itself, being of no common sort, call for retribution of no ordinary calibre. England will do everything that Germany hopes for most dearly of all if you return to the state of "business as usual" with her when the guns are no longer barking. You business men have a stupendous and inspiring task before you in seeing that German dreams of rehabilitating German trade, in British markets at least, remain blasted for all time. As one who is your unqualified well-wisher, I devoutly trust you will rise to the opportunity and master it.

After a brief discussion, Mr. D. N. Dunlop, the Secretary, said that he did not agree with all that Mr. Wile had said. German methods had brought about this war, and he thought that they would bring about the downfall of Germany. What was needed was a strong Federal Association of all the organisations in this country. A Minister of Commerce was not of much use unless he was backed by a capable organisation. A Board of Trade Committee was sifting out the facts in regard to the trade position, and the B.E.A.M.A. was taking an active part. It had appointed overseas committees, and was appointing correspondents all over the world. It was by taking off the coat that we should win. The work was not going to be done all at once. He believed in co-operation, and by co-operating they would succeed. The Council had given, and was giving, consideration to many matters, and it was backed up by the men of the different departments. There was no need for pessimism. What was wanted was strong co-operation of all interests in the industry, and if a little patience were exercised it would be found that when the war was over they would by co-operation with the Institution and with Government Departments have available a structure, which was being slowly put together, which would greatly benefit British trade.

Mr. Davenport, in closing the proceedings, said that the Association was trying to avoid a policy of "wait and see." It was hard to find time to get the people who should be interested in the subject to give their attention to it. There were indications that the Government Departments were waking up to the seriousness of the future position. German competition would be extremely severe after the war, and there was a need for a closer Imperial Brotherhood between the Colonies and the Allied countries.

POWER STATION SWITCHGEAR.

Mr. P. V. Hunter, Chairman of the Newcastle-on-Tyne Local Section of the Institution of Electrical Engineers, in his inaugural address on November 8th, spoke at length on power-station switchgear. He said that the diversity of opinion as to the correct design and arrangement of power-station switchboards was most striking. It was common to find two power stations of similar date, in close agreement as to general design and lay-out, but differing radically in the arrangement of the switchgear. He gave illustrations in diagram of the bus-bar connections of five important power stations in this country and in America. The fundamental difference between the various arrangements was the degree in which they provided for internal breakdown of the switchboard; the more complicated arrangements made the more complete provision. They might correctly define the function of switchgear as being to maintain supply by isolating faulty sections. It was also logical to insist that before perfection was secured, switchgear should not only isolate faulty sections, but also provide against interruption of supply in the event of a breakdown of any part of the switchgear itself. On the whole, such differences in design as were met might be reasonably expected, since they were dealing with something quite outside calculation, namely, the probability of an accident to, or the failure of, any part of the switchboard.

After illustrating various types of bus-bar arrangements, Mr. Hunter said that it would seem quite reasonable that, if the effect of a bus-bar fault had to be limited, the proper way to do it was to divide up the bus-bars into a large number of separate parts, each part being so small that it included one section of the system only, the working of the remainder being independent of it. To some extent the degree of complication would depend on the character of the load. On certain loads little opportunity occurred for taking generators and feeders out of service, and in these circumstances bus-bar switches would have to be more frequent.

It was a fairly safe rule not to include more than two generators on one division of bus-bar, and if the generators were exceptionally large it was better to reduce the number to one. Speaking of the more common troubles met with in switchgear, he said these were, according to his own experience, and arranged in order of frequency of occurrence:—(1) Mistakes made by operating staff; (2) unforeseen effects; (3) failure of apparatus due to weakness or deterioration.

The most frequent mistake on the part of operators was to open the isolator of a feeder carrying load, instead of the one next to it. Notwithstanding the serious risk of such accidents, they did occur, really due to the fact that a switchboard consisted of a large number of parts of identical appearance, the only distinction being the labelling. Various suggestions for the adoption of distinctive colouring, etc., had been made, but the most satisfactory arrangement was a complete system of screens and interlocking. The arrangement could be made to provide that no access could be obtained to conductors while they were alive on account of the screens being automatically locked under these conditions. The oil switch was interlocked with its isolators, so that the latter could not be opened or closed while the oil switch was closed. There still remained the difficulty that the feeder terminals might be alive through some mistake in not opening

the switch at the other end of the feeder. This was met by replacing the disconnecting switches, normally used between the switch and the feeder, by a set of earthing switches.

Interlocking, if adopted at all, must be complete, as partial interlocking led to more accidents than its complete absence. The bus-bars had to be dealt with separately. A simple method was to treat each length of bus-bars as a unit, and place it and the isolating switches disconnecting it from the oil switches, in a gallery. Access to the bus-bars was obtained by means of a door at each end of the gallery only. A locking bar from end to end of the gallery was provided. This bar could not be rotated into the position that allowed the two doors to be opened until every oil switch connected to the particular length of bus-bar (including the bus-bar switches) was open and isolated.

These precautions, if carefully designed and constructed, were not expensive compared with the alternative of more complicated switchgear, and should give immunity from mistakes leading to breakdown on the switchboard itself.

Under the heading of unexpected effects, the principal item was abnormal mechanical forces occurring on short circuits. Most trouble had been experienced with isolating switches opening unexpectedly. These forces were generally recognised, and could be provided against. Another possible source of trouble was the fusing of the primary winding of current transformers having wound primaries.

Referring to oil switches, he said it was not so generally known that the vapours and gases given off when opening heavy loads were highly conducting; he had known cases where oil switches had successfully opened heavy short circuits, and the gases afterwards escaping from the switch had produced another short circuit outside the switch.

The failure of switchboards through deterioration was a rare occurrence. Experience had led to the use of materials of permanent character, and, in particular, rubber insulation for high-tension circuits had been abandoned.

In conclusion, he said he felt sure that it was a better procedure to adopt arrangements preventing those particular faults to which switchgear was most liable, rather than to regard the faults as inevitable, and provide complicated arrangements to limit the extent of them. Experience led him to the view that it would be a mistake to attempt to standardise switchboard arrangements, or switches. His personal opinion was that there was a strong probability that future development would include, not only safety interlocks, but the complete abandonment of bare conductors for high-tension power station switchboards, and that the security of supply thus obtained would justify the use of a minimum of switchgear.

THE ELECTRICAL INDUSTRY AND THE WAR.

On Thursday last week Mr. H. Hodgson Wright delivered his inaugural address as Chairman of the Yorkshire Local Section of the Institution of Electrical Engineers, from which we make the following extracts:—

The one outstanding fact that this world-war has taught us is that success cannot be won without the aid of the engineer and mechanic, and an organised production of munitions of war on a scale far vaster than ever imagined before. In no previous war has the engineer, both mechanical and electrical, played such an important part.

The highest and most specialised skill of our engineers, metallurgists, and chemists is directly pitted against the skill of the enemy in the production of new designs, new metals, and explosives. Every new weapon must be an improvement on the last, thus the war is proving a great spur to invention in every branch of engineering.

Science has been organised: its units have been registered and the best brains of the professors and students of science throughout the Empire are being made use of.

Twelve months having passed since the admirable inaugural address of our immediate past chairman, I propose to devote a few remarks retrospective to some of the points raised on that occasion. They have an even greater significance to-day, in the light of the present situation.

That address very properly indicated the duties devolving upon those of our profession remaining in civil life. I only propose to refer to three of these duties, which are interdependent and inseparable.

The first is: "To do all possible to support the sentiment 'business as usual' with regard to the electrical industry in particular and all other British industries in general."

Whilst this sentiment was then admirable in itself to indicate that our factories must be kept going, it must not have the effect of weakening our determination to put the last ounce of energy into the production of munitions.

At the present time, therefore, the sentiment "Nothing as usual" would be more appropriate. Twelve months ago, only our largest engineering works were organised for the production of munitions. Now nearly all, irrespective of size, are "controlled" by the Government.

Secondly: "To assist in every way possible the efforts which are being made by British manufacturers to capture and retain foreign and colonial trade which until recently has been in the hands of alien enemies."

During the war we have an industrial breathing time so far as German and Austrian competition is concerned. What measures are we taking as an electrical manufacturing industry, either individually or collectively, to conduct the coming industrial war?

Once hostilities are ended, the ability and organisation of Germany will be directed to underselling us in every market of the world. Prohibitive tariffs will, to a large extent, prevent her trading with Belgium, France, Italy, and Russia for many years. Whether we shall allow her to compete freely with us and our Allies, within the Empire, is, I hope, at least doubtful. A much restricted world market is, for her, in any case, certain.

Nor shall we ourselves be free from severe competition by our Allies and by neutrals, particularly America. In Germany economic causes will force a reduction of wages, and a flood of cheap German goods will result. No great wage reductions are probable in this country.

To meet these conditions we must cheapen production by better organisation, improved machinery, designs, and co-operative sale methods. Increased efficiency of production and the utilisation of existing and new scientific methods are absolutely necessary if we are to hold our ground against the coming competition.

We need a higher and more general standard of specialised technical education for our engineers. It is here that Germany has gone ahead, and she has reaped the benefits of that education in the organisation of her factories.

Many manufacturers still continue the old-fashioned sale methods of waiting for customers instead of waiting on them. There must be a complete change of these methods.

A much closer study of foreign markets is needed; for that purpose a thorough technical and commercial education is as necessary for our salesmen as for our engineers. Much foreign business has gone to our competitors owing to our neglect and lack of commercial organisation in foreign markets. Our expert salesmen should have passed through every shop and should have held positions in the estimating and designing departments, and should be capable of advising customers on highly technical questions.

If financial reasons prevent the employment of a staff of highly salaried commercial experts abroad, then costs may be reduced by co-operative sale methods.

By carrying the same principle a step further, electrical manufacturers would extend their foreign markets by combining to charter an electrical exhibition ship fitted up with those goods which are most in demand. The cost per firm need not be much more than that of a land exhibition. The ship might be chartered every four or five years, and the stay at each port would be determined by the importance of the market.

I am confident that a co-operative scheme of this kind is possible, and would result in the capture and retention of much valuable trade formerly held by enemy competitors.

Far too little attention has been given by our sales engineers to the study of foreign languages, and I strongly recommend our junior members, whose duties may take them to foreign countries in later years, to learn at least one language besides their own. Yet it appears to me that, however perfect we may be individually as salesmen, and however closely we may study foreign markets, there will still be wanting for complete success that organised State assistance which Germany has so lavishly extended to her foreign industry.

Our foreign trade can never be fully developed without diplomatic, legislative, and financial assistance. The Board of Trade, as at present constituted, and the diplomatic and consular services, as carried on by the Foreign Office, are not adequately equipped for the encouragement and protection of our foreign trade. The Board of Trade was originally intended to deal primarily with transport, *i.e.*, shipping, railways, and carrying agencies.

The great spending departments of the Government are controlled by the Admiralty and War Office. Is it not quite as important that the earning, or trading, side should be also controlled by a separate Government Department?

A permanent and non-party Board of Industry is required, presided over by one of our most experienced business men and advised by a permanent staff of experts.

It is almost incredible that practically no funds are set aside by the State for the purpose of advancing foreign trade. In the year 1913-14 the amount of our foreign trade was over 1,400 millions, yet the cost of running the whole of the Board of Trade, including the home departments, was only £213,000.

Apart from the consular services, the Foreign Office staff interested in trade in foreign countries usually consists of commercial attachés, having little or no special knowledge or commercial training, and who use their office as a step to advancement. But the limited number of these officials renders their work of small value; China, with a population of 400 millions, and a yearly import trade of 80 million pounds, has one commercial attaché.

It would be the business of the Board of Industry to appoint qualified trade commissioners in our colonies, dependencies, and all foreign countries, whose duty it would be to collect and report to headquarters all useful information as to trade openings and the activities of our foreign competitors, to negotiate for improved and, if possible, preferential trade relations, notably in connection with international loans, and to counteract and prevent the dissemination of false and injurious political and commercial information by enemy competitors.

Thirdly, "To consider carefully the methods of educating and training young electrical engineers with a view to re-organising and improving such methods, in order that in future the designing as well as the manufacture of all electrical apparatus required for the naval and military services, shall be carried out by British-born subjects. Special attention should also be given to business training, so that the business methods of British firms may be entirely up-to-date and their sales organisation controlled by Britishers."

The importance of the proper scientific training of our electrical engineers and, indeed, the complete overhauling of our present education system, is a subject which is vital to the electrical industry.

It is a remarkable fact that England, the birthplace of modern industry, is the last of the great nations to build up its educational system. We are still behind other great nations in making public provision for the higher branches of education.

Even at the present day we have no national system other than that of elementary education, which is very far from meeting the needs of the nation.

The inseparable relationship between education and national success in commerce and industry is a fact which hardly needs proof, but which will become more accentuated as years go on, due to the higher standard of training required by our artisans and engineers.

One of the first duties of our legislators after the war should be to provide the country with an organised system of compulsory primary and secondary education, forming a co-ordinated step to our technical high schools and universities.

The leaving age for primary schools should be raised, and the continuation schools made compulsory. The last period at the primary school should be devoted to a pre-apprenticeship training, during which the youth's aptitude, or otherwise, for engineering would be proved.

Our present haphazard apprenticeship system results in lads being put into trades for which they have no natural ability, and the financial position of the parents only too frequently demands that the boy be put to the trade which pays the highest wages, irrespective of his aptitude for it.

It should be the special duty of the teachers during the pre-apprenticeship period to note the boys likely to be suited to skilled handicrafts.

The teachers should be encouraged to acquire a first-hand knowledge of the scope and requirements of the local engineering trades by study and visiting the works. A much closer collaboration between the education authorities and the engineering employers is necessary, and would lead to more suitable youths being selected for trade apprenticeship.

It is gradually becoming recognised that the only effective way to train the rising generation of skilled workmen after leaving the elementary schools is to have half-time in the workshop and half-time in the technical school between the ages of 14 and 18.

A number of our principal technical schools give a two or three years' day course of instruction for student apprentices during the winter months. These are steps in the right direction, and I should like to see the scope of the classes widened to form part, or an extension, of our elementary education system, with the grant of a leaving certificate. This certificate would be a guarantee that the boy had attained a definite standard of education, and would thus gradually become a qualification required by the engineering employers for trade apprentices.

Usually engineering works do not provide special facilities for practical training, and the apprentice has to pick up such experience as he can in a more or less haphazard fashion. In a few British and certain German and American works, special schools and training shops are provided. One, at least, of our foremost electrical manufacturing concerns has an admirable apprentice school.

The instruction is divided into two classes: "General" and "Trade." The "General" class is a continuation of the apprentice's regular education, and affords proof that our elementary education system is not turning out boys sufficiently educated to make their way into skilled trades. The remedy for this is in the trade schools.

The second or "Trade" class is devoted purely to trade teaching, and consists of youths selected from the "General" class.

The teaching of both classes is undertaken by the firm's engineering staff, assisted by leading foremen and shop engineers, and is carried out in working hours and at the firm's expense.

The first object of the school is to turn out good workmen; its second to fit them for promotion to positions as charge hands, foremen, and inspectors. The quality of the workman is thus raised, and with it the standard of the foremen.

Whilst it is both possible and profitable for a large firm to provide its own trade school, for small works it would be impossible for financial and economic reasons, except by a co-operative school system to which each firm would send its own teachers and pupils. Such a system would not be easy to carry out in practice, owing to difficulties of distance, etc.

It is to be hoped that ultimately the need of such schools will be met by half-time trade classes provided by the education authorities in all large industrial centres.

It must be noted that the improved educational facilities discussed will gradually result in increased numbers rising from the ranks of labour to fill the commissions of the engineering industry.

The foregoing remarks apply to those the majority of whom are likely to remain workmen all their lives. The education of our technical engineers is built up on the secondary or public schools, forming an intermediate step to the higher technical school.

In this country we make the mistake of allowing technical instruction to be given too early, instead of postponing it till after the completion of a thorough secondary education.

If it is desirable that our primary instruction be a matter for public control and supervision, it is doubly the case with our secondary and higher instruction. So long as State control stops here and no contact and co-relation exists between our popular instruction and the instruction above it, so long will our education system be unsatisfactory.

The primary school naturally presses up to the secondary sphere, and the secondary to the university or higher technical school. They should be inseparable and co-related, thus forming a highly efficient instrument for the avoidance of friction and competition. But not only must the steps in the education ladder be inseparable in the sense indicated, but there must be a closer association between our universities and technical high schools and the engineering industry. Much of their work is of a purely academic character, and has little practical application.

I am convinced that great advantages would result to the electrical and engineering trades if they would submit those problems to the universities for solution, which they have neither the staff nor the time to solve. Such a connection could not fail to be of great mutual value, and would result in manufacturers taking a keener interest in technical education and the teaching staff being in closer touch with industrial problems.

Immediately the war is over Germany will endeavour, at all costs, to recapture her lost foreign trade, and we may be certain she will flood the world with low-priced German goods. The strongest weapon we can forge to meet that competition is without doubt to look carefully to the better training of our artisans and engineers. The Institution is one of the channels through which we can make our influence felt on questions within its legitimate scope, and there can be no doubt that technical training is one of them.

WAR ITEMS.

Trade After the War.—In several of the daily papers just now considerable space is being devoted to the urgent need that exists for securing an early statement from the Government regarding our national after the war policy concerning trade. The Council of the Association of Chambers of Commerce of the United Kingdom is stated to have framed the following resolution respecting the prospect of wholesale German dumping:—

Trade After the War.

Inasmuch as large numbers of our soldiers will return to industrial employment after the war it is necessary to look ahead in order that nothing may be allowed to occur likely to lessen their opportunity of obtaining employment and a livelihood. It is thought that Germany may pour into this country large quantities of manufactured goods, at low prices, in competition with the products of our working people, depriving our people of a market and thereby reducing employment. This Council beg to warn his Majesty's Government of such a possibility, and consider that the Government should be prepared well in advance with a considered and matured plan, to prevent unemployment caused by the action of German manufacturers, and to secure continuity of business for those who have undertaken enterprises with the hope of obtaining a portion of trade formerly done in competition with British subjects by those countries with whom we are at present at war. This Council strongly impresses upon his Majesty's Government the necessity of deciding its policy in connection with this question before the time shall have arrived when the feared mischief may have begun, shortly after the conclusion of peace and the re-opening of the markets of the world.

One of the papers states that the London Chamber of Commerce is holding a special meeting this week to consider the whole question of trade relations after the war between Great Britain and her Dominions and the Allies on the one side, and our enemies on the other. It is said that a prize of £1,000 will probably be offered for the best scheme of trade defence submitted to competent judges by January 1st next. The Council of the London Chamber is understood to be making further representations to the Government in favour of the more general adoption of the metric system of weights and measures, and to urge members of the Chamber to introduce the system into their own businesses without delay.

A Berne telegram to the "Morning Post" states that it is reported from Vienna that Germany has induced the Austrian Chamber of Commerce, at a plenary meeting, to agree virtually to all her demands regarding a future economic and commercial union between the Austrian and German Empires. Austro-German commercial policy will be based on a unified plan, and both countries will negotiate and conclude in common all commercial treaties with other States. It is stipulated that Germany and Austria must agree, before beginning peace negotiations, upon the economic demands which they intend to put forward, and to include Hungary in the Austro-German economic treaty.

Perhaps it will not be out of place if at this point we quote the views of the "Spectator" respecting the future

position of German industry:—"After the war every German manufacturer will find that his buildings and plant and his house, and every permanent form of wealth he possesses, are heavily mortgaged, and that the interest upon this mortgage is a first charge upon his business. It is quite true that the interest will be payable to other Germans, but that fact will not reduce his expenses of production. From this point of view the burden upon his future industry is exactly as great as if the interest were payable to Americans. Nor is there any way of his escaping this increased cost of production except by repudiating his debt. Thus, so far from the German industry being unassailable after the war, it will be heavily embarrassed by the debts which the German Government have contracted to pay for the war. Our own position will be relatively better, not indeed because we have borrowed abroad, but because we have raised at any rate some portion of our war expenditure out of current taxation."

We may conclude our references to this matter by alluding to a question asked in the House of Commons on November 10th, and the Prime Minister's reply thereto. Mr. Fell asked whether the Prime Minister would take the opportunity to be afforded by the expected presence in this country of the leaders of several of the Dominions, to hold a conference with them to consider the steps to be taken throughout the Empire to meet the flooding of the whole Empire with cheap goods from enemy countries, which was expected at the conclusion of the war. Mr. Asquith, in reply, said that "this and any other question of interest to the Empire" would be discussed when the opportunity was given by the presence in this country of the Dominion Government representatives. As already announced in our pages, The Parliamentary Committee of the Allies is to meet in Paris in January to consider important trade questions that will call for common action at the end of the war.

Proposed Cable Manufacturing in Australia.—According to an Australian paper just to hand, a conference took place at Melbourne on September 29th with the Federal Attorney-General and representatives of the copper producers of the Commonwealth, with a view of arriving at an agreement by which ore should be treated in Australia instead of being exported. Representatives of all the principal copper-producing firms were present. Mr. Hughes stated at the conclusion of the conference that the proposal was that ore should be treated in Australia to produce metallic copper, and, further, that copper goods, particularly wire, cables, tubes, etc., required for Australian consumption, should be manufactured in the Commonwealth. The conference was unable to reach finality, and a further meeting is to be held at a later date.

Electricity Works and Depleted Staffs.—Mr. A. D. Chalmers, Mr. D. W. Ritson, and ten other employés at the Gillingham (Kent) Electricity Works, have asked permission to join the reserve forces for the period of the war. As the matter is a serious one, and as the Council may be deprived of practically the whole of the staff, the matter has been referred to the Electricity Committee for consideration.

Blackburn Corporation has decided that it must retain the services of men in the gas and electricity works. These number 100, and there are 29 other employés of military age considered indispensable.

Italy.—Voluntary patriotic effort on behalf of the war is as much evident among Italians as with us, and our contemporary, "L'Elettrotecnica," gives a list of 45 of the most considerable electric supply associations and electric manufacturers who are pecuniarily assisting the families of their staffs at the front, keeping their situations open, subscribing to the funds of the Red Cross Hospital and to local relief committees, subscribing to the National Loan for themselves or assisting their employés to subscribe, and otherwise evincing their solidarity with the national aims in the present crisis.

Hot-Plates in Submarines.—Last winter, through an appeal made in the "Morning Post," a flotilla of our submarines was provided with electric cooking hot-plates. A letter from a Lieutenant-Commander shows how these hot-plates are "tremendously appreciated." Their use, he says, will be more frequent than ever in the winter that is now at hand.

Restricted Lighting.—The "Times" states that owing to the number of fatal accidents in Manchester due to the darkened streets, the local Watch Committee has petitioned the Home Office authorities to remove, or at least modify, the lighting restrictions.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

15,369. "Telephonic receivers." E. A. Graham. November 1st. (Complete.)

15,390. "Electrical instruments." Eversheds & Vignoles, Ltd., J. C. Needham, and S. F. W. Finnis. November 1st.

15,406. "Electrical indicating devices for electrical pianos and the like." H. Richardson & H. E. Gill. November 2nd.

15,421. "Electro-magnetic power transmission and conversion system." J. Dollard & H. W. Brown. November 2nd.

15,427. "Electric coupling appliances." J. B. McIndoe. November 2nd.

15,447. "Electric switches." W. L. Wise & British Thomson-Houston Co., Ltd. November 2nd.

15,448. "Circuit connections of electron discharge apparatus." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). November 2nd.

15,459. "Electric lampholders." General Accessories Co., Ltd. (L. Rosenthall & C. Seymour, Transvaal). November 2nd. (Complete.)

15,460. "Electric adaptors." General Accessories Co., Ltd. (L. Rosenthall & C. Seymour, Transvaal). November 2nd. (Complete.)

15,471. "Apparatus for adjustably holding X-ray tubes." E. H. Hanson and H. W. Cox & Co., Ltd. November 2nd. (Complete.)

15,514. "Pumps." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). November 3rd.

15,518. "Telephonic receivers." E. A. Graham. November 3rd. (Complete.)

15,525. "Means for compensating for leakage in wave transmission systems." G. Constantinesco & W. Haddon. November 3rd. (Complete.)

15,539. "Alarm fuses for telephone, telegraph, and like systems." Automatic Telephone Manufacturing Co., Ltd., J. Savin, & S. R. Smith. November 4th. (Complete.)

15,555. "Electric resistances." British Thomson-Houston Co., Ltd. (General Electric Co., United States). November 4th.

15,563. "Construction of electric switch." G. Markt. November 4th.

15,579. "Telegraph apparatus." W. J. Mellersh-Jackson (Western Union Telegraph Co., U.S.A.). November 4th. (Complete.)

15,595. "Construction of dynamos and electro-motors." H. B. Mansell and G. Walker. November 5th.

15,633. "Protective devices for electric circuits." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). November 5th.

15,652. "Switchboards especially applicable to military portable telephone sets." H. J. B. Hampson. November 5th.

15,681. "Operating rotary converters and other alternating-current machinery." A. H. Railing & C. C. Garrard. November 6th. (Addition to 10,841/13.)

15,685. "Electric heating device." Landis & Gyr Akt. Ges. November 6th. (Convention date, November 9th, 1914, Switzerland.) (Complete.)

15,695. "Method of making vitreous bodies." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). November 6th.

PUBLISHED SPECIFICATIONS.

1914.

21,096. Alternating Electric Current Circuits in which Condensers are employed. British Insulated & Helsby Cables, Ltd., and H. Higham. October 17th.

21,145. Electrically-actuated Tools. W. J. Mellersh-Jackson (Commonwealth Electric Tool Co., U.S.A.). October 17th.

21,184. Electrical Pressing Irons. A. E. Reimers & F. F. Kiefer. October 19th.

21,266. Telephone Systems. E. G. Godfree. October 20th.

21,388. Wireless Signalling Systems. British Thomson-Houston Co. (General Electric Co., U.S.A.). October 22nd.

21,593. Electric Switches. C. H. Miller. October 27th. (October 28th, 1913, U.S.A.)

21,998. Electrical Switches. H. Leitner. November 4th.

23,238. Electric Batteries. F. J. Beaumont. November 28th.

23,314. Electric Heat Radiators. A. B. Neiman. November 30th.

23,653. Simplified Method for Localisation of Bullets and other Foreign Bodies by means of X-rays. G. G. Blake. December 7th.

1915.

180. Electric Starting Devices for Motor-driven Vehicles. Maschinenfabrik Oerlikon. January 5th. (January 29th, 1914.)

459. Brush-holders for Dynamo-electric Machines. A. B. Back. January 12th.

1,694. Ionisation Devices for Amplifying Electric Currents. Western Electric Co., Ltd. (Western Electric Co., U.S.A.). February 3rd.

4,076. Storage Battery Separators and process for making same. T. A. Willard. March 15th.

5,104. Electric Motor Controllers. Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co., U.S.A.). April 1st.

6,302. Electrically-actuated Tools. W. J. Mellersh-Jackson (Commonwealth Electric Tool Co., U.S.A.). October 27th. (Divided application on 21,143/14, October 17th.)

6,364. Electrically-actuated Tools. W. J. Mellersh-Jackson (Commonwealth Electric Tool Co., U.S.A.). October 28th. (Divided application on 21,143/14, October 17th.)

6,738. Electrically-actuated Tools. W. J. Mellersh-Jackson (Commonwealth Electric Tool Co., U.S.A.). May 5th. (Divided application on 21,145/14, October 17th.)

8,047. Electric Switches for Lighting Installations. Robert Bosch (firm of). May 31st. (June 9th, 1914.)

8,903. Electrical Relays. V. Tedeschi & A. Rossi. June 16th.

Telephony on Air-Ships.—In *La Lumière Electrique* a brief description is given of a new telephone outfit which has been devised by the company "Le Matériel Téléphonique" for the use of the pilot and passenger in an aeroplane. The noise of the wind and the propeller renders conversation in the ordinary way impossible. The equipment consists of a head-set with two watch-type receivers, which are closely applied to the ears, and a special type of transmitter which is worn on the breast under the clothing, between the neck and the third rib. The apparatus are connected by flexibles and plugs to a circuit provided in the fuselage, and a battery of three dry cells is supplied, capable of maintaining communication for 100 hours. It is stated that conversation can be carried on no matter how great the noise of the air and the propellers.